The uptake of wildlife research in Botswana: a study of productive interactions

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Declaration

By submitting this research assignment electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third-party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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Abstract

This study set out to identify and understand whether research carried out in or about Botswana has been focused on producing useful and used work in the area of wildlife and related natural resources, with a view to improving the management of these resources. The study investigated this by examining the interactions of researchers and stakeholders engaged in the management, conservation and use of wildlife resources in northern Botswana.

This work draws on the idea that broader societal impact of research can be estimated by following interactions of researchers with potential users of their research throughout the research process. This approach, based on the idea of productive interactions, acknowledges the difficulty of attributing the uptake, use, and impacts of research findings, and moves the focus of investigation from outcomes at the end point of investigation to all the stages and processes of research. Interactions of researchers with potential users of the research - its stakeholders - increase the likelihood of research findings being put to use. In the thesis, this process is viewed through the concept of an extended community of practice that demonstrates mutual engagement, joint enterprise, and shared repertoire.

The study used a mixed methods case study approach including literature review, surveys of principal investigators working under Government of Botswana permits and audience members of a public outreach event, interviews, analysis of document content and bibliographic records, and ad hoc participant observation to establish patterns of interaction among researchers and stakeholders working in northern Botswana, and to investigate perceptions of research use.

The study found that the northern Botswana's research community of practice consists of a strong core of researchers based in academic institutions and Non-Governmental Organisations (NGOs) who interact with more loosely connected members of the private sector and several levels of government, and with local community members. Findings included that researchers who engage with non-academic stakeholders outside the inner core of this community of practice at early stages, and throughout the research process, are more likely to see their research applied. Their success also appears to be linked to their commitment to working longer-term in northern Botswana, which allows for more, and deeper, interactions with stakeholders.

Findings of this study point to validation of the concept of productive interactions in a local community of practice, with effects that extend beyond Botswana and southern Africa. While productive interactions are already taking place in this community, many of them brokered by NGOs, increased deliberate incorporation of the productive interactions approach into the practice

of government managers, researchers, and the tourism private sector is likely to increase the relevance, awareness, and uptake of the resulting findings, and to build trust and understanding among research stakeholders.

Keywords: research uptake, productive interactions, communities of practice, Botswana, wildlife conservation, wildlife research, regulatory processes, research permits, conservation science, communication in science, public engagement, acknowledgements, environmental awareness, environmental information, science-policy interface, knowledge exchange, outreach.

Opsomming

Hierdie studie fokus op navorsing wat in of oor Botswana gedoen is, spesifiek navorsing op die gebied van wildlewe en verwante natuurlike hulpbronne. Die studie het probeer bepaal of sodanige navorsing gerig is op die skep van bruikbare en gebruikte werk ten einde hulpbronbestuur te verbeter. ’n Fokuspunt van die studie is die interaksie tussen navorsers en belanghebbendes wat betrokke is by die bestuur, bewaring en gebruik van natuurlike hulpbronne in die noorde van Botswana.

Die uitgangspunt van die studie is dat die breër impak van navorsing in die samelewing verstaan kan word deur die interaksies tussen navorsers en die potensiële gebruikers van navorsing tydens die navorsingsproses te volg. Hierdie benadering is gebaseer op die idee van produktiewe interaksies, wat die attribusie-uitdaging in studies rakende die opname (*uptake*), gebruik en impak van navorsingsbevindinge omseil, deur die fokus te verskuif vanaf uitkomste aan die eindpunt van navorsing na al die stadiums en prosesse van navorsing. Interaksies tussen navorsers en die potensiële gebruikers van navorsing – die belanghebbendes – verhoog die waarskynlikheid dat die navorsingsbevindinge gebruik sal word. In die proefskrif word hierdie proses beskou aan die hand van die konsep van ’n uitgebreide praktykgemeenskap wat elemente van onderlinge betrokkenheid, gesamentlike onderneming en gedeelde repertorium toon.

Die studie het ’n gemengde-metode, gevallestudiebenadering gevolg, wat ’n literatuuroorsig behels het sowel as opnames (van projekleiers wat navorsingpermitte onder die Botswana-regering verkry het, en van deelnemers aan ’n openbare uitreikgeleentheid), onderhoude, ontledings van dokumentinhoud en bibliografiese rekords, en *ad hoc* deelnemerswaarneming. Die doel was om interaksiepatrone tussen navorsers en belanghebbendes wat in Botswana werk te identifiseer, en om persepsies oor navorsingsgebruik te ondersoek.

Die ondersoek het bevind dat die navorsingsgemeenskap in die noorde van Botswana ’n sterk kern van navorsers behels wat in akademiese instellings en nie-regeringsorganisasies gebaseer is, en wat met die minder geskakelde lede van die private sektor, verskeie regeringsvlakke en die plaaslike gemeenskap omgaan. Bevindinge dui ook daarop dat navorsers wat vroeg in die navorsingsproses betrokke is by nie-akademiese belanghebbendes buite die kern van die praktykgemeenskap, se navorsing meer geneig is om toegepas te word. Dit blyk of hul sukses in hierdie verband ook gekoppel is aan hul verbintenis om langer in die noorde van Botswana te werk, wat meer en dieper interaksie met belanghebbendes moontlik maak.

Bevindinge van hierdie studie dui op die validering van die konsep van produktiewe interaksies in ’n plaaslike praktykgemeenskap, met effekte wat verder strek as Botswana en Suid-Afrika. Alhoewel produktiewe interaksies reeds in hierdie gemeenskap plaasvind (baie daarvan bemiddel deur nie-regeringsorganisasies), sal die doelbewuste inkorporering van die produktiewe interaksiebenadering in die praktyk van regeringsbestuurders, navorsers en die toerisme-private sektor waarskynlik die relevansie, bewustheid en opname (*uptake*) van navorsingsresultate verhoog, en ook vertroue en begrip onder die navorsingsbelanghebbendes bou.

Sleutelwoorde: opname van navorsing, produktiewe interaksies, gemeenskappe van praktyk, Botswana, natuurbewaring, wildnavorsing, reguleringsprosesse, navorsingspermitte, bewaringswetenskap, wetenskapkommunikasie, openbare betrokkenheid, erkennings in tesisse, omgewingsbewustheid, omgewingsinligting, wetenskapbeleid-koppelvlak, kennis uitruil, uitreik

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Abbreviations and acronyms

APU	Anti-Poaching Unit
BDF	Botswana Defence Force
BDSC	Botswana Documentation and Special Collection, University of Botswana Library
BiOKAVANGO	Building Local Capacity for the Conservation and Sustainable use of Biodiversity in the Okavango Delta
BPCT	Botswana Predator Conservation Trust
BWMA	Botswana Wildlife Management Association
BWTI	Botswana Wildlife Training Institute
CBNRM	Community Based Natural Resource Management
CBO	Community Based Organisation
CCB	Cheetah Conservation Botswana
CHA	Controlled Hunting Area
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CKGR	Central Kalahari Game Reserve
COP	Community of Practice
CSO	Civil Society Organisation
DEA	Botswana Dept. of Environmental Affairs
DFRR	Botswana Department of Forestry and Range Resources
DWNP	Botswana Department of Wildlife and National Parks
EDF	EU Economic Development Programme
EFA	Elephants for Africa
EIA	Environmental Impact Assessment
EU	European Union
EWB	Elephants without Borders
FAO	Food and Agriculture Organisation of the United Nations
FMD	Foot and Mouth Disease
GBIF	Global Biodiversity Information Facility
GEF	Global Environment Facility
HOORC	University of Botswana Harry Oppenheimer Okavango Research Centre
ICDP	Integrated Community Development Project
INGO	International Non-Governmental Organisation
IPA	Important Bird Area
KAZA TFCA	Kavango Zambezi Transfrontier Conservation Area
KCS	Kalahari Conservation Society
KRC	Kalahari Research and Conservation
MENT	Botswana Ministry of Environment, Natural Resources Conservation and Tourism
NGO	Non-Governmental Organisation
NORAD	Norwegian Agency for Development Cooperation
ORI	University of Botswana Okavango Research Institute (*see also* HOORC)
PAC	Problem Animal Control
PI	Principal Investigator
RADP	Remote Area Dwellers Development Programme
SAREP	USAID Southern African Regional Environmental Program
TBNRM	Four Corners Transboundary Natural Resources Management Area
UB	University of Botswana
UNDP	United Nations Development Programme
WMA	Wildlife Management Area

Lay summary

written for members of the public, rather than researchers or professionals

Scientists study wildlife and natural areas in Botswana to discover ways of understanding and conserving animals and their habitats. The results of their research – the findings – can be used to support good management of the country's important economic resources and enable decision makers to make evidence-based decisions and policies. These findings are often not available to the people and organisations that are responsible for managing Botswana's wilderness areas. Even if the research findings are available, they are often not used when decisions are made, or new policies are crafted. The research takes time and money to produce, so how can its results be better used? Are there more effective ways to make sure that everyone who might use the results knows about them, and understands them?

This thesis studies this question by looking at how research scientists interact with the people who might use their results. This is to find out if there are more and better opportunities for researchers to share their discoveries with those who are interested and those who need the new knowledge that is being produced.

This study uses three examples to explore these questions: the experience of some principal investigators who worked under Botswana Government research permits, a public event where researchers explained their work to a general audience, and student theses written about Botswana's wildlife and natural areas.

The study finds that if researchers involve potential users in their work from the beginning of their research projects, and continue to share information throughout the project, there is a better chance that the research findings will be considered and used.

Chapter 1 Introduction

> "This approach is process-oriented, valuing the small but necessary steps in an intricate course of interactions … taking into account the vital role of the contributions of researchers and stakeholders alike." (Spaapen & Van Drooge, 2011, p. 216)

1.1 Motivation and rationale for the study

The setting for the research described in this thesis is Botswana, where, especially in the country's north, natural protected areas are the focus of the country's lucrative wildlife-based tourism industry, and where much research about the conservation of wild animals and wilderness is carried out. My investigation was motivated by hearing the frequent complaint from the local private sector, government, and civil society that most wildlife researchers came for short periods from other countries with pre-defined research ideas, did not let local people know what they were doing, and neglected to share their findings in Botswana after their work was completed.

I came to northern Botswana in 2005 to manage a library and spent four years working with research outputs intended to inform the management of a protected wilderness area. The above-mentioned complaint was frequently coupled with one, often from researchers themselves, that it was difficult to find existing research about the region, and that research findings supplied to government 'gathered dust' on office shelves. The natural response was to ask, if the research is produced, why is it so difficult to find, and to be put to use? This thesis is an attempt to contextualise the conditions and dynamics that surround these questions, by focusing on the processes that contribute to the uptake of wildlife research in Botswana.

While Botswana is a small country in terms of its human population, its wealth of natural resources and experience in management of wildlife has given it a place on the global political stage. Since the research for this thesis began in 2014, there have been many public discussions connected with concerns about the governance of natural resources, the influence of the West over conservation policies and economic incentives for protecting wildlife, and even the human-nature relationship itself. Many of these discussions make reference to the role of science in providing evidence to inform management of natural resources. For this reason, questions explored by the thesis, and its findings, should be relevant to researchers, practitioners and policy-makers beyond Botswana and other African countries.

1.2 Enabling conceptual lenses for the study

This study focuses on processes that lead to research uptake and use – defined broadly as evidence that research results have been recognised, considered or acted upon within and outside the academic environment. Research uptake is, in this study, the process whereby research findings

enter the 'domains' of intended and unintended multiple audiences such as policy-makers, the public, scholars, and practitioners (Boshoff, 2012). This process can be considered as leading to societal impact if it can be shown that change – any effect on a target problem, such as declining vulture populations, for example – has resulted from application of the new knowledge or understanding (Koier & Horlings, 2015). This includes, if possible, looking to see if research has been used as evidence, but does not attempt to establish or measure any resulting impact outcomes.

Lindgreen et al. (2020) have made the point that societal value can be achieved only if research has both societal relevance and societal impact: relevance when research produces results that have use and benefit beyond science, and impact when there is demonstrable (and measurable) contribution to society and the economy. This thesis focuses on the first, making use of the concepts of community of practice (Wenger, 2011) and productive interactions (Spaapen & Van Drooge, 2011) that focus on the importance of mutual engagement of researchers with potential users – the stakeholders of research – throughout the stages of scientific investigation and dissemination. This engagement can be seen to function as an indicator of the likely uptake of research, even if it is impossible to predict specific outcomes or societal impact.

1.2.1 Productive research-stakeholder interactions

There is a major difficulty in attributing specific research findings to impacts on society over time, or even to track uptake and use of research findings by others. For this reason, Spaapen and Van Drooge (2011), as a result of a European Union FP7 project (2007-2013), *Social Impact Assessment Methods for Research and Funding Instruments through the study of 'Productive Interactions' between Science and Society* (SIAMPI), proposed that following the interactions of researchers with stakeholders during the research process would reveal work most likely to be adopted for use, and perhaps to result in societal impact. Their theory was that data could be gathered, which could provide useful information about steps necessary to achieve social impact, and about relationships with stakeholders. SIAMPI's designers considered interactions to be productive when they were exchanges between researchers and stakeholders in which scientifically robust and socially relevant knowledge was produced. Later this definition was refined to include the idea that interactions were productive when they led to other interactions.

Focusing attention on the research process rather than 'final' outputs such as publications, enables a more nuanced understanding of the labour of research, in terms of both emotion, and time and financial resources, opening up more possibilities for valuing academic contributions to society (Olmos-Peñuela, Benneworth, & Castro-Martínez, 2016).

Studies carried out using the SIAMPI framework have revealed a variety of channels of interaction, adaptation to stakeholder needs, evolution of new, unplanned interactions, and overlapping

stakeholder boundaries – all rich sources of possible uptake and use that have been identified by scholars of knowledge production as meeting the conditions of awareness, relevance, trust, and understanding (Boshoff & Sefatsa, 2019; Esterhuyse, 2019; Matt, Colinet, Gaunand, & Joly, 2015; Wolf, Lindenthal, Szerencsits, Holbrook, & Heß, 2013).

The productive interactions approach can be seen to align with the view of contribution as opposed to attribution: a piece of research contributes – perhaps as one of many other pieces of research – to possible outcomes, rather than directly causing the outcome. The productive exchange of knowledge takes place, some scholars argue, when actors work together at a point of problem, co-producing new knowledge.

Working together across usual boundaries of sector, discipline, and profession has also been emphasised as a condition for effective communities of practice.

1.2.2 Communities of practice

Etienne Wenger (1999) popularised the term 'Community of Practice' to describe how shared knowledge and joint experience constitute a common pool of expertise and, characterised by interactions among members of a group, to form a social system. He defined three dimensions of a community of practice:

1. Mutual engagement: being included in what matters, sharing diverse knowledges and points of view, and building personal relationships
2. Joint enterprise: participation in a collective process to gradually define how the practice develops and create mutual accountability
3. A shared repertoire: a common language, symbols, and actions that are together a resource for the negotiation of meaning (Wenger, 1999).

Wenger saw these dimensions as nodes of communication that facilitated the exchange of knowledge. Communities of practice can be made up of researchers only, or of a mix of 'stakeholders': actors with a common interest – vested or other – in a field of inquiry or a resource. Their relevance to the productive interactions approach is that if they have a lifespan greater than that of a research project, they can be understood to support and reinforce the beneficial interactions that can indicate likely uptake of the project's research.

The research for this thesis has combined the concepts of productive interactions and communities of practice to frame its investigations. The investigations were structured around three key study components, to be discussed next.

1.3 The three study components explained

The empirical part of this thesis consists of three study components, two of which look at specific existing systems and mechanisms that support the uptake of research in the context of Botswana's

wildlife management and conservation: a government system that regulates research, and a mechanism for research outreach in the form of a public event. Both of these involve different kinds of research-stakeholder interactions. The third component focuses on issues of measurement and comprises two sub-parts: whether written acknowledgements in student theses and dissertations in Botswana reflect research-stakeholder interactions, and whether scholarly outputs of research in Botswana, and their citations, provide evidence of uptake in the form of capacity-building.

1.3.1 Component 1: a government system that regulates research

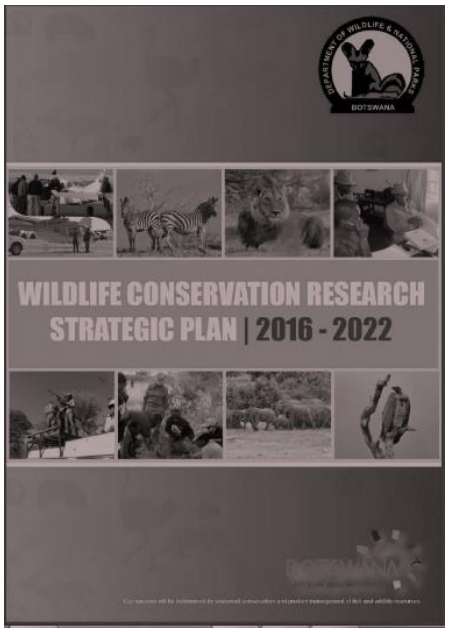

Figure 1-1 Strategic research plan of the Botswana Department of Wildlife and National Parks (DWNP)

Many countries have regulatory systems for directing and controlling research work carried out within their borders. These systems typically set standards for ethical research, and, depending on the academic discipline, provide guidance for acceptable methodology in the collection of data. In some cases, these systems aim to support policy for scientific work that is relevant to national development priorities. While these regulatory systems usually apply to all scientists, whether domestic or foreign, there is often an emphasis placed on researchers who come from outside the country and require visas. The scientific study of nature and wildlife is often carried out in protected areas, adding another regulatory process to that imposed by immigration control. While on the surface these regulatory processes appear to be administrative, rather than substantive in the context of research, they represent a key point of interaction in the science-policy interface (Engel, Gebauer, & Hüncke, 2015; Paul & Sikes, 2013).

The role of government regulatory processes in ensuring awareness of, and access to, biodiversity data and information was highlighted in the recommendations of a 2012 study commissioned by the Convention on Biological Diversity:

> Where Governments are in a position to give permission for research to proceed, unless there are good reasons why not they should consider making it a requirement of that permission that electronic copies of all data and information generated are deposited in a timely manner in designated institutions, using appropriate standards. At smaller scale, similar approaches can be adopted by, for example, protected area administrators in granting research permission in any given protected area, who might require submission of data and information to a specific institution (UNEP World Conservation Monitoring Centre, 2012, p. 24)

Since regulatory processes to document and track wildlife research may already exist, these provide an opportunity to acknowledge productive interactions between researchers and wildlife stakeholders that are already taking place, and to facilitate them where they might not have been before. As in other countries, Botswana has a government-wide system of research permits for directing and controlling research work carried out within its borders.

The case study of Government of Botswana research permits issued between 1996 and 2014, analysed through the conceptual lens of productive interactions, reveals opportunities that might influence the type of wildlife data collected, its sharing, and future re-use for the benefit of Botswana's management of wildlife and other natural resources.

1.3.2 Component 2: a platform for research outreach in the form of a public event

Public engagement events, where researchers share their work with non-specialist audiences, can lead to uptake and change through a series of productive interactions that contribute to conditions conducive to uptake. Face-to-face public engagement events as fora for multi-directional flow of knowledge provide an opportunity for gaining better understanding of the nature of interactions that can lead to uptake. These events can lead to a loosening of social barriers that often give academic researchers an 'upper hand' because of their perceived superior status and scientific expertise, levelling the knowledge playing field. Examining interactions between researchers and the non-academic stakeholders of research, requires then looking at whether this levelling takes place through meaningful exchange to create the conditions of awareness, relevance, trust and understanding. Productive interactions both depend on, and create, these conditions, and highly structured platforms such as public lectures provide an opportunity to observe and capture them.

Figure 1-2 Interactions at *Research Talks for Everyone* event, 30 April 2018

This thesis argues that wildlife research in northern Botswana is carried out in a community of practice, with a range of channels and spaces for interactions that result in exchange of knowledge and learning. The case study of a collaborative effort by a private sector tourism operator and a university research institute to engage with the broader community in the form of a public lecture series (called *Research Talks for Everyone*), provides an opportunity to examine the potential of such platforms to lead to research uptake.

1.3.3 Component 3a: acknowledgements as proxies for productive interactions

Tracing productive interactions between researchers and potential users of research is a way of estimating the influence or contribution to broader society that research may have when it is difficult or impossible to measure impact. There are challenges to using surveys and interviews to elicit accounts of productive interactions that are likely to lead to uptake and further use of research, as these often depend on anecdotal evidence that requires a thorough understanding of social context. These interactions are also often not documented in a systematic way that allows extraction of meaningful patterns because they are not usually recognised as significant and of value in academic reward systems. It is possible, however, to look at existing outputs of research that indirectly provide this documentation function to see if they can function as proxies for productive interactions.

Scholarly publications, including theses and dissertations produced by students, are one such output. The acknowledgement sections of these documents are a potential source of evidence for interactions between researchers and the people who were of assistance to them –cognitively, technically, financially, and morally – during their research work (Mantai & Dowling, 2015). It can be argued that encounters and exchanges that are memorable enough to be included in written acknowledgements flag productive interactions. As a source of information about direct and indirect interactions that supported researchers working under Botswana research permits, the written acknowledgements in the theses and dissertations produced by that work can provide insights to improve our understanding of the social context of the research and of the possibilities for its uptake.

1.3.4 Component 3b: scholarly outputs as evidence of capacity-building uptake

Figure 1-3 Ruth Lekoko, University of Botswana Library, with research output follow-up forms, 2014

The increase of research capacity is a form of uptake that benefits broader society. Scholarly publications offer another possible proxy to use in investigating the outcomes and uptake of research through analysing how they develop capacity of other scholars, especially students. The academic mentorship system involves multiple interactions – between students and professors, and among researchers – that directly build research capacity. The academic publishing system also builds capacity indirectly through advancing the sharing and creation of new knowledge. Whether these interactions are productive, leading to more uptake of the research findings published, can be

interrogated by following their documented influence on other research, or on policy and practice.

Citation analysis – measuring the relative importance or impact of an author or a publication by counting the number of times the work is cited by others – is routinely used as a proxy for the visibility of research in evaluating academic success (Moed, Burger, Frankfort, & Van Raan, 1985). The technique may also be used to trace the influence of a piece of research on other scholarly outputs, indicating re-use and uptake through the building of research capacity.

Following the production and dissemination of specific outputs produced under Botswana research permits can reveal both direct and indirect capacity-building outcomes in the country, region and internationally.

1.4 Aims and objectives of the study

In light of the aforementioned discussions, the study was guided by two broad aims, each with its own set of research objectives.

The **first aim** was to determine whether research carried out in or about Botswana has been focused on producing useful and used work in the area of wildlife and related natural resources, with a view to improving the management of these resources.

Three research objectives supported this aim, namely:

- To describe and investigate the nature of communities of wildlife research and practice in Botswana, including the interactions of stakeholders, as informed by two real-life cases: a government system that regulates research, and a mechanism for research outreach in the form of a public event
- To investigate whether and how wildlife research findings generated by researchers working in Botswana have been shared and taken up, as informed by the two real-life cases above
- To critically reflect on channels, tools and methods that could support productive interactions and effective uptake of wildlife research findings in Botswana.

The **second aim** of the study was to establish whether analyses of existing research outputs could act as suitable proxies for research-stakeholder interactions as well as providing evidence of uptake in the context of wildlife research in Botswana.

This ‘methodological’ aim had two associated research objectives:

- To analyse written acknowledgements in student theses and dissertations as possible pointers to productive interactions in the execution of wildlife research in Botswana

- To investigate both direct and indirect capacity-building uptake effects of research on wildlife in Botswana, based on a classification of research outputs and citation analyses of such outputs.

1.5 Research questions

The research objectives of the study, as outlined in the previous section, translated into a set of specific research questions to be answered through the study. The research questions and their alignment with the objectives are summarised in the following Table 1-1.

Table 1-1 Research objectives and questions

Objective	Questions	Section
1. To describe and investigate the nature of communities of wildlife research and practice in Botswana, including the interactions of stakeholders, as informed by two real-life cases: a government system that regulates research, and a mechanism for research outreach in the form of a public event	Who are the research stakeholders in wildlife research in Botswana, and what is the nature of their roles and interest?	Section 2.5, Chapters 5 and 6
	What kind of interactions take place between researchers and other stakeholders?	Chapters 2, 5, 6, and 7
2. To investigate whether and how wildlife research findings generated by researchers working in Botswana have been shared and taken up, as informed by the two real-life cases above	Does sharing of research data and information among researchers and other stakeholders lead to uptake and use?	Chapters 5 and 6
	Do researcher characteristics or other conditions affect the uptake and use of research?	Chapters 5 and 6
3. To critically reflect on channels, tools and methods that could support productive interactions and effective uptake of wildlife research findings in Botswana.	Can regulatory systems support productive interactions?	Chapter 5
	Do productive interactions that lead to changes in thinking and use take place through planned outreach activities such as public seminars?	Chapter 6
	What types of tools and methods used to share research findings in Botswana are most effective in supporting effective uptake?	Chapters 5 and 6

Objective	Questions	Section
4. To analyse written acknowledgements in student theses and dissertations as possible pointers to productive interactions in the execution of wildlife research in Botswana	Does the content of written acknowledgments reflect productive interactions between researchers and other stakeholders?	Section 7.2
5. To investigate both direct and indirect capacity-building uptake effects of research on wildlife in Botswana, based on a classification of research outputs and citation analyses of such outputs	Can outputs from research carried out in Botswana be used as evidence of uptake through capacity-building?	Section 7.3
	Is wildlife research carried out in Botswana taken up through building the knowledge and skills of African researchers?	Section 7.3

1.6 Outline of the thesis

The thesis has eight chapters. This chapter has introduced the work and set out the reasoning behind the research. A summary of the structure and contents of the remaining seven chapters follows.

Chapter 2 presents an overview of conservation research in Botswana, drawing on historical and some interview sources. The review traces the development of research policy, regulation and practice in the Botswana Government's designated steward of wildlife resources, the Department of Wildlife and National Parks (DWNP), identifies the roles of stakeholders in Botswana's wildlife research community of practice, and describes trends and milestone events in the region's wildlife survey work. The theme throughout is the decline of wildlife and wilderness in Botswana, and the efforts of researchers to engage productively with government and other stakeholders to address this issue. It points out that the study of wildlife in the country has been well recognised and supported by the country's principal steward of natural resources – the Botswana Government – and that many and varied interactions between researchers and stakeholders in wildlife research have contributed to knowledge of wildlife and its habitat.

The scholarly literature explored in **Chapter 3** makes the point that creating useable research depends on interactions between researchers and potential users – or stakeholders – throughout the research process. It presents important concepts in conservation science research and reviews the findings of scholarship that has investigated the uptake of research in conservation science and related disciplines to identify key conditions needed for uptake. The chapter introduces the concepts of productive interactions and communities of practice as frameworks that can explain how contact and knowledge exchange between researchers and stakeholders produce these conditions.

Chapter 4 provides a description of how the methodology used in the thesis research developed through three main phases of study. A first phase of exploratory context work included review of historical literature, case sampling through initial interviews, and engagement with the local community of practice. A second phase of intensive data collection took place through survey work and follow-up interviews, followed by data analysis.

Chapter 5 presents a case study of the Botswana Government's regulatory system for managing wildlife research permits through a survey of permit holders between the years 1996 and 2014. A survey interrogated the experiences of principal investigators through capturing their interactions with stakeholders in government, local communities, other researchers in Botswana and outside the country, and with Botswana NGOs. The survey also collected the PIs' data sharing practices, and their perceptions about use of their research. Interviews supplemented the findings of the survey.

In **Chapter 6**, another case study explores a local public knowledge-sharing event where researchers present their work to a broad audience over a two-year period. The chapter presents the results of a survey and follow-up interviews focused on interactions among presenters and audience members, and perceptions of research uptake and use.

Chapter 7 describes an investigation of outputs produced under the research permits examined in Chapter 5, to determine if the content of these outputs can be used as proxies for productive interactions that might lead to research uptake. This is done in two parts: the first an examination of acknowledgements in theses produced under permit and, second, through citation analysis, tracking the influence of these theses and other outputs of the research permits on building of research capacity within Botswana and beyond.

Chapter 8 discusses the findings presented in the previous three chapters in relation to the objectives of the thesis. Based on analysis of these findings, it offers recommendations for improving the uptake of wildlife research in Botswana and explores whether what was learned in the investigation can increase understanding of the fields of research uptake, science-policy interface, and knowledge exchange research.

Chapter 2 Wildlife research in northern Botswana

2.1 Introduction

"The biomass available represents some 5500 tonnes of meat ….(Patterson, 1987, p. 8)" *From 1987 report of an aerial survey of the Okavango Delta*

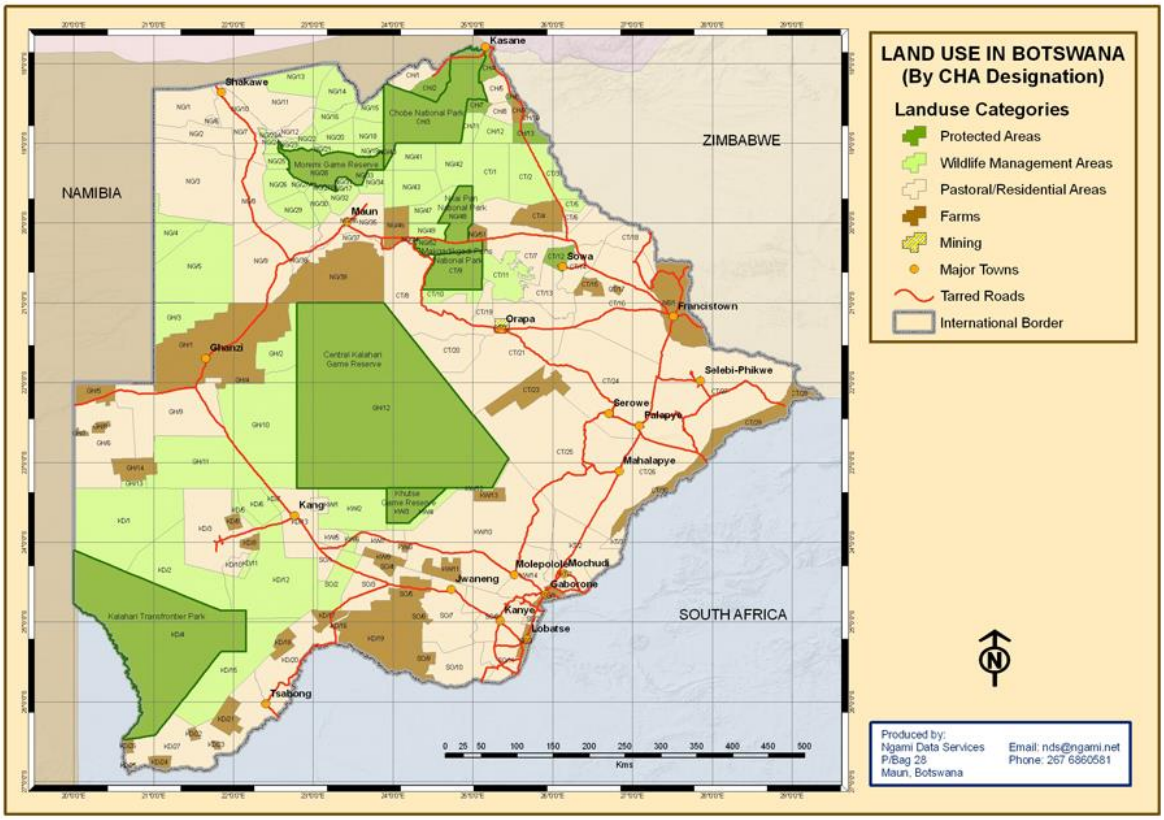

Figure 2-1 Land use map of Botswana

This chapter sets the scene for the overall study by reviewing the nature of wildlife research carried out in northern Botswana since the 1960s, focusing on collection of data through wildlife surveys, a process that engaged multiple stakeholders. The review traces the development of research policy, regulation and practice in the Botswana Government's designated steward of wildlife resources, the Department of Wildlife and National Parks (DWNP), identifies the roles of stakeholders in northern Botswana's research community of practice, and describes trends and milestone events in the region's wildlife survey work. The theme throughout is the decline of wildlife and wilderness in Botswana, and the efforts of researchers to engage productively with government and other stakeholders to address this issue.

The chapter reviews the literature generated by research about wildlife in northern Botswana through a thematic, rather than strictly chronological, approach. It looks at how concern about the size and location of wildlife populations, in particular mammals, developed from the colonial period, and was institutionalised in the form of policy, regulation and activity. First, I look at the literature for evidence of wildlife decline, explanations put forward by researchers, and expressions of the need to address the issue. I follow with an examination of the influence and interactions of people and organisations involved with wildlife research in the region, referring to selected important surveys, and then of the literature generated through the application of several important management interventions.

Wildlife research in northern Botswana, and, in parallel, the conservation and management of wilderness, has been shaped by the predominant view of wild animals and their surroundings as consumable resources. While the value of biodiversity, and wildlife in particular, as providing ecosystem services that extend beyond food for human populations is the current dominating scientific paradigm, wildlife management and research in Botswana was shaped by hunting until the mid-2000s. Decline of the region's highly visible large mammal populations, sometimes the result of natural causes such as drought and disease, or at the hand of human beings, has been a documented concern for more than two hundred years. Reasons for the decline, and appropriate management interventions, have not been generally agreed upon by scientists and managers.

The story of wildlife research in the region has been dominated by the Botswana government because most of the research carried out has been commissioned by government to support management. The literature reviewed in this chapter, while documenting the active involvement of multiple stakeholders in data collection, also reveals a pattern of irregular use of this research resource by the country's

wildlife stewards, against a background of recurring themes: cross-sectoral agreement about the value of wildlife, inconsistent data collection and stewardship, issues of relevance, policy that was not necessarily aligned with conservation objectives, low status of conservation agencies, poor ability of researchers to communicate effectively with policy-makers, and inability to implement proposed recommendations. Nevertheless, decline of wildlife populations was recognised as a problem, research was consistently identified as a necessary tool in finding solutions, and interactions between researchers and potential users of research was a constant.

2.2 Evidence of decline and examination of causes

> "Ignorance about the finiteness of wildlife is real …" (Mordi, 1989, p. 148).

Declines in Botswana's wild animal populations, in particular large mammals and birds, have been observed and documented since the early days of the Bechuanaland Protectorate. Intensive hunting with firearms by colonial traders and farmers in the 1820s to 1840s was part of what DeGeorges and Reilly described as the 'asset stripping' by colonial expansion in southern Africa (DeGeorges & Reilly, 2008). A disease, Rinderpest, led to many more wildlife deaths in the 1890s (Kalahari Conservation Society, 1995, p. 62). Stuart Marks wrote that concerns of Protectorate Police led to development of a "… dual slate of game laws and judicial functions…" in the late 1800's in the face of indiscriminate hunting of wild game (Marks, 1993).

From the early 1900s, settlers and cattle farmers in northern Botswana fought tsetse fly – a leading cause of cattle sickness and death – by killing large numbers of wildlife, cutting down wide swathes of trees, erecting fences to exclude wildlife from cattle grazing areas and human settlements, and eventually, spraying with insecticide. This activity, including killing of wild herbivores that were the hosts of the insect, continued until the 1960s (Bolaane, 2007, p. 111; Dziewiecka, 2012, pp. 292–299)[1].

In the 1968 checklist prepared as part of the country-wide Botswana Mammal Survey, Smithers noted:

> Many factors, however, are in operation to disturb the status of the wild life populations as, for example, the enormously increasing cattle populations of the territory, the opening up of waterless areas to cattle by making this available to underground supplies, and the erection of great lengths of fencing, designed to control cattle and wild life movements, which appear in some cases to have cut across lines of movement of wild life, with disastrous results. (Smithers, 1968, p. 8)

[1] Final eradication of tsetse in the region was accomplished through aerial spraying in the mid-2000s.

In spite of this, Botswana still was richer in wildlife resources – in particular, plains game – than many other countries on the African continent, and in 1961 the Protectorate government introduced the Fauna Conservation Proclamation to exploit this resource through promotion of trade in wildlife products and safari sport hunting (Spinage, 1991, p. 18). The long-term result of this policy was to reduce local subsistence use of wildlife and introduce abuse of the permit system in the 1970s through the illegal sale of citizen hunting licences to well-equipped hunters who over-harvested the animals (Kalahari Conservation Society, 1995).

Raseroka's 1975 study of the range of buffalo in Botswana reviewed the environmental and land use changes that appeared to have contributed to the decline of large herbivores in the region, and to their concentration in regions that made their numbers appear greater (Raseroka, 1975).

The 1976 report of the Central Kalahari Game Reserve Reconnaissance Survey, a project of the Basarwa Development Plan carried out to provide information about the human population of the Reserve and its hunting practices, included collection of data about wildlife densities, movements and abundance, from interviews with resident hunters. The survey found that more than half of the hunters interviewed perceived a lowering of abundance of the animals they hunted (M. L. Murray, 1976, pp. 25–26).

In 1978 and 1979, the European Development Fund, under the Lome Convention – a trade and aid agreement between the European Economic Community (EEC) and 71 African, Caribbean, and Pacific (ACP) countries – funded the first aerial wildlife surveys of the southern and central parts of the country (DHV Consulting Engineers, 1979). These were followed by aerial surveys of parts of northern Botswana by the DWNP, Kalahari Conservation Society, and others in the 1980s:

> The DWNP instituted country-wide aerial surveys in 1986 in response to a number of wildlife management challenges. Botswana experienced a severe drought in the 1980s which resulted in high mortalities of both livestock and wildlife. Some boreholes were later established to provide water for wildlife, particularly in the Central Kalahari Game Reserve. It was also observed that elephants were degrading vegetation over a large part of their range and that their numbers had to be controlled (Bonifica, 1992). Some issues associated with these challenges were, however, contentious and required information before any management decisions could be made. The necessity to consumptively utilize the wildlife resource as part of a sustainable management approach also called for information on distribution and abundance in order to set realistic hunting quotas. (Botswana Dept. of Wildlife and National Parks, 2012, p. 1)

A 1982 seminar held by the Botswana DWNP in Maun, focused on conflicts between development and conservation, with government biologists suggesting that expansion of cattle ranching, with its drilling of new boreholes, fences and competition for grazing, was largely responsible for the decline in wildlife species, noting in particular population crashes in 1964, 1970 and 1980 (Botswana Dept. of Wildlife and National Parks, 1982, pp. 23, 35).

Mishken, in the introduction to his proposed draft of the Botswana Wildlife and National Parks Act in 1986 wrote:

> ….Botswana's wildlife is a national asset of paramount importance and… could play an increasing role in sustainable development and economic growth in Botswana…. But there is no guarantee that this potential will be realized. Already, many of Botswana's wildlife populations are declining, Drought, certain veterinary fences and illegal hunting have taken their toll, making it clear that long-term survival of Botswana's wildlife cannot be taken for granted. (Mishken, 1986, p. 1)

Arntzen and Veenendaal wrote about Botswana's wildlife declines in the context of land degradation when they prepared their 1986 report for UNEP's Technical Clearing House work:

> There is no conclusive evidence as yet that wildlife numbers in the country are decreasing permanently. Variations have always occurred based on climatic conditions. However, the present combination of expanded human activities and drought is new and may lead to structural changes in wildlife composition and numbers, necessitating active management. (Arntzen & Veenendaal, 1986, p. 103)

Botswana's Wildlife Conservation Policy of 1986 acknowledged a decline, pointing to drought and anthropogenic causes:

> In recent years Botswana has experienced increasing human population pressure. This has led to attendant developments such as a commercial livestock industry, arable farming and other activities that claim their share of the available land. The growth of population has particularly affected the mobility of wildlife. The absence of game in areas where was once plentiful is apparent … disease control cordon fences have had the effect of impeding the free migration of wildlife. …This results in high wildlife mortalities. (Government of Botswana, 1986, p. 3)

By the 1990s, Stuart Marks noted that Spinage was noting more declines in many species, caused by "… drought, by changes in land use, and by relatively easy access into remote lands by various types of hunters" (Marks, 1993, p. 184).

Thomas and Shaw summarised similar reasons for the decline in their 1991 book, *The Kalahari Environment,* emphasising the role of protected areas:

> The increasing confinement of the Kalahari's large wild animals in parks and reserves and the use of such areas for tourism has therefore generated the need for careful management within as well as beyond such areas. The Department of Wildlife and National Parks (DWNP) in Botswana, in contrast with neighbouring countries, is, however, hopelessly undermanned and underresourced, with a ratio of one staff member per 20952 of reserve land …. the worst such ratio in Africa. As such, the Department is unable to cope with the basic duties of game and tourist management and has been identified as a major obstacle to the implementation of satisfactory environmental management strategies …. (Thomas & Shaw, 1991, p. 238)

Botswana's National Development Plan 7 in 1991, devoted 10 pages to wildlife management, noting and attributing a "general decline in biomass" to drought conditions (Botswana National Development Bank, 1991, pp. 300–309).

A symposium organised by the Kalahari Conservation Society and the Chobe Wildlife Trust in November 1995 was held to discuss "… the steady decline of wildlife over the last 20 years", pointing out that there was a lack of awareness among the country's urban population that "… the abundant wildlife resources documented by the countrywide Animal and Range Assessment Project of the 1970s …" were no longer there. Presentations at the symposium included a breakdown of major species numbers, as well as repeated references to the vested interests of the beef cattle industry, and calls, by many of the participants, for more effective DWNP management. Suggestions for these improvements included real political support for the Department, decentralisation of decision-making to the local level, attention to human community needs, and application of the DWNP's Joint Venture Guidelines to commercialise conservation efforts. Doug Crowe of the DWNP summarised the need for change in the organisation:

> The Director of DWNP has no more authority than a clerk. … What is needed is a change in the internal structure of the department. We have to connect the political will with on the ground activities, maybe to achieve this we require a parastatal organization. (Kalahari Conservation Society, 1995, p. 125)

As part of the symposium discussion of solutions, Mark Dangerfield of the University of Botswana suggested that communication among wildlife stakeholders was an issue:

> … how can we communicate what we want to say to who needs to hear it. It has not been done in the past which is always the difficulty. If the decision makers are not hearing what is being said then we need to change the way it is being said so they do listen. We need a group that can speak to the president and politicians and be respected by them and not dismissed as the 'lunatic fringe'. We also need to take this message abroad, get it out so that the international community will be aware of what is going on and exert some influence over the politicians of this country. (Kalahari Conservation Society, 1995, p. 139)

The handover report of Doug Crowe, the Assistant Director Research at DWNP from 1992 to 1995, stated plainly, "The wildlife resource is declining. … As with most problems there is no single cause or solution. … will become more pronounced if measures are not adopted to stem the causes of decline" (Crowe, 1995, pp. 2, 5). He subsequently called for development of a comprehensive national strategic plan for the conservation and management of wildlife resources.

A study of the impact of Botswana's Beef Protocol market agreement with the European Union in 1996, which required erection of veterinary fences to separate cattle from wild buffalo populations that carried Foot and Mouth Disease (FMD), reaffirmed the decline of wildlife and the lack of effective management response from the resource's managers:

> The severity of the depletion of the country's wildlife resource is the key underlying theme of all natural resource management reports written over the past decade and one which seriously undermines both the broader role that tourism can play within the economy, and its more specific contribution to rural people's livelihoods. Regrettably the Government's explicit commitment to wildlife conservation through the provision of protected areas, the establishment of a National Conservation Strategy, the commissioning of management plans and an eloquent vision for tourism within the economy as stated within NDPVIII, repeatedly fails to be borne out by any meaningful implementation. (Perkins & Ringrose, 1996, p. Executive Summary)

The study pointed out, using language such as *paradoxical* and *duality*, lack of uptake of research findings about the efficiency and sustainability of Botswana's traditional cattle post system in the face of the commercial ranch model, and highlighted the lack of communication between the government's Department of Veterinary Services and Department of Wildlife and National Parks as one cause of implementation failure (Perkins & Ringrose, 1996, p. 15).

A workshop co-organised in 1997 by the DWNP and KCS in 1997 again defined its focus in terms of the decline of wildlife populations. Botswana's Minister of Finance and Development Planning, F.G. Mogae, in his keynote address, reiterated the value of wildlife to the country's economy:

> About two decades ago, Botswana was renowned for its abundant and varied wildlife species as well as its pristine wilderness areas of unrivalled scenic beauty. As we hold this conference today, the situation has changed significantly to the extent that we can no more boast of huge populations of certain wildlife species. This is despite the efforts made by the government of Botswana in safeguarding the integrity of this natural heritage. … the reported declines are in direct conflict with government policies of sustainable utilisation of wildlife including the promotion of community based wildlife management programmes. (Botswana Dept. of Wildlife and National Parks & Kalahari Conservation Society, 1997, pp. 3, 4)

At the same meeting, the DWNP's Kgwamotsoko's chronology of national policies outlined a series of events and unaligned government interventions with "… inadequate provisions for the protection of wildlife", calling for prioritised attention to habitat degradation (Botswana Dept. of Wildlife and National Parks & Kalahari Conservation Society, 1997, p. 183).

Richard Mordi summarised researchers' concerns about Botswana wildlife population declines "in absolute numbers and species diversity" from 1953 onward. He cited policy failure, habitat loss, zoonoses, and over-harvesting as contributing factors for the decline, and added, through his study of attitudes and perceptions among Batswana, the belief that "Chronic tension was found to exist between proconservation wildlife policies of the state and the anticonservation cultural milieu in which the public found itself" (Mordi, 1987, p. i). Lesley Boggs summarised the evidence for decline, and provided support for the validity of the wildlife population data used, saying that the long-term trends show "… a consistent decline in some species of wildlife and a decreasingly mobile population as a result of fences" (Boggs, 2000, p. 13).

Addressing the issue of trustworthiness of survey data, she pointed out:

> There has been some discussion surrounding the validity of the wildlife population data specific to the northern system. First, it has been argued that data for the northern system is less reliable than that in the south due to large confidence limits associated with the difficulty of counting smaller herbivores in dense woodland (Perkins and Ringrose 1996 and Bell 1998 pers. com). It has been counter argued that as the aerial survey technique is consistent over the years, so too is the error (Crowe 1995 and McNutt 1998, pers. com). As a result of the debate all available analysis disregards real numbers and looks only at trends in dominant species. (Boggs, 2000, p. 13)

Boggs also described other explanations for the decline of wildlife numbers:

> Second, the general mobility of the wildlife population in Botswana has been cited as a reason to question the validity for any one region. These concerns are however outweighed by the long term trends that show a consistent decline in some species of wildlife and a decreasingly mobile population as a result of fences. … Other hypotheses for wildlife decline throughout Botswana are: cyclical but prolonged drought, expansion of a commercial cattle industry via boreholes in vast areas otherwise inhospitable to livestock and therefore reserved for wildlife, the continual loss of wildlife habitat to mineral exploration, cattle and human populations, and an expanding tourism industry. The combined effect has been the channelling of wildlife into increasingly isolated populations throughout the whole of southern Africa. (Boggs, 2000, p. 13)

She reiterated the observation that the declines were most noticeable among Botswana's previously large migratory herds:

> …. What these data show is that wildlife populations throughout Botswana are in decline. The northern system, although not entirely isolated, has become an overall wildlife refuge and essentially an island population for large water dependent ungulates. Key species including buffalo and zebra are declining along with several other ungulate species. Until there is evidence to the contrary, it is necessary to assume that some wildlife species in northern Botswana are in a state of decline. (Boggs, 2000, p. 15)

The Botswana Central Statistics Organisation (CSO) highlighted the decline and summarised available explanations of its causes in a 2005 publication that listed data from DWNP aerial surveys, Problem Animal Control registers, and hunting and harvesting licenses and quotas:

> At the national level, total wildlife offtake quotas for 2004 are lower than their 1997 levels for all species with the exception of elephants, baboons, jackal black bird, crocodile and eland. The species whose 2004 quotas are at least 70 percent lower than their 1997 levels are: springbok (94 percent), lechwe (91 percent), duiker (90 percent), steenbok (85 percent), gemsbok (84 percent), kudu (83 percent), warthog (77 percent), spotted hyeana (76 percent) and impala (70 percent). No offtake quotas were allocated to lions, reedbuck, sable and sitatunga during the years 2002, 2003 and 2004, because the populations of these species were considered to be declining. (Botswana Central Statistics Office, 2005)

This publication was updated in 2011 and 2015, each time emphasising the decline of many of the counted species, and including an explanation of causes (Botswana Central Statistics Office, 2011; Botswana Statistics Botswana, 2015).

Changes in wildlife populations were acknowledged in many of Botswana's national development plans (NDPs) (Botswana Dept. of Wildlife and National Parks & Kalahari Conservation Society, 1997, p. 177), summarised in NDP 10:

> The overall wildlife biomass in Botswana has increased substantially over the past 10 years. The bulk of the increase has resulted from the doubling of the elephant population between 1994 and 2006. As a result, human-elephant conflict is on the rise outside the protected areas. On the other hand, there has been a decline in populations of springbok, hartebeest, reedbuck, tsessebe and wildebeest. Some of the decreases might be attributed to increased human activities in the southwestern ecosystem whose integrity is under serious threat. (Botswana Ministry of Finance and Development Planning, 2009, p. 271)

In Botswana's 2007 implementation strategy for multi-lateral environmental agreements, wildlife decline was highlighted as an issue:

> Botswana possesses a wide diversity of wild fauna and flora including populations of globally endangered and rare species. Despite this diversity, wildlife numbers have been declining over several decades due to illegal hunting, drought, and habitat destruction. Some species, such as the Black and White Rhino appear to have been poached to extinction in national parks and game reserves. However, a small population of White Rhino has been re-established in a

> secure sanctuary. There has also been a major decline in the population of springbok. A notable exception to the general decline in wildlife populations has been with regard to elephants, whose population doubled between 1991 and 2001. Other species that show an increase, but on a smaller scale, include buffalo, eland and giraffe. (Keatimilwe, Mpotokwane, & Moatlhaping, 2007, p. 3)

The report of a 2010 joint aerial wildlife survey of northern Botswana, carried out by the DWNP and Elephants without Borders, a non-governmental organisation (NGO) in Botswana, showed significant declines in most recorded wildlife species compared to aerial surveys conducted by the DWNP in 1996: impala, zebra, tsessebe, kudu, giraffe, and lechwe numbers were significantly reduced (Gifford, 2013). Only two species (elephants and Cape buffalo) were reported to have increased since the 1996 surveys (Chase, 2011). "Explanations to account for these declines vary widely and are speculative at best", wrote Tico McNutt, but studies of illegal bushmeat hunting seemed to indicate that "… illegal hunting may be the most significant factor to account for the wildlife population declines in northern Botswana" (Botswana Dept. of Wildlife and National Parks, 2014b).

2.3 Scientific research in the region and its application to wildlife management

> "This isn't a management decision – it is a political one." *Doug Crowe, DWNP, 1995* (Crowe, 1995, p. 15)

In view of the long and ongoing concern about the decline of wildlife populations in northern Botswana, it seems appropriate to ask, have the responses to this concern in the wildlife management regimes in Botswana been based on use of scientific research and evidence?

Stuart Marks' criticism of the management regimes imposed in Botswana on wildlife management, first by British colonial administrators, and later, by the international tourism industry and conservation NGOs, was based on the premise that the knowledge and norms of local communities were ignored. His review (Marks, 1993) of wildlife ecologist Clive Spinage's *History and Evolution of the Fauna Conservation Laws of Botswana* (Spinage, 1991) argued against Spinage's assertion that wildlife law, and its management implementation in Botswana, had evolved in a natural and rational way, based on sound evidence gained in practice in other contexts. Marks' point of view was that the imposition of wildlife laws in Botswana without adequate research into local social needs, had led to serious disagreements about the legitimacy of the protected areas established to conserve wildlife.

Spinage later responded that the growing view of Marks and other researchers, of African wildlife management law as imported and inappropriate, was wrong, and that the continuation of colonial legislation after the independence of many countries was evidence that "… African governments wanted to control the resource just as much as the colonial authorities had done" (Spinage, 1996, p. 178). Increasing human populations, access to firearms, and changes in traditional authority, Spinage further said, made enforcement of centralised wildlife laws necessary. He claimed that the populist approach of many social scientists and some 'çonverted' ecologists like Marks, that argued against establishment of large protected areas, and for handover of wildlife management to local communities, was not based on ecological or historical evidence, saying that these "…sociologists and anthropologists ... might temporarily assuage man's avidity, but they are ill-equipped to consider animals and plants as other than a means to that end" (Spinage, 1998, p. 275).

This academic, or perhaps more accurately, political, difference of opinion, based on a divergence between community-based, as opposed to centralised, authority, has influenced much of the story of wildlife research in Botswana. This is a story of research driven by centralised management policy, driven by a dominant ethnic group, situated in the country's seat of national government, Gaborone (Matswiri & Mamotse, 2017). This policy was based on the use of wildlife as a commercially exploitable natural resource, first as game for hunters, then as harvestable sources of meat and by-products, and most recently as the basis of a tourism industry.

The account by Jane Carruthers (2007) of changing paradigms in South African wildlife management informs the Botswana experience, even though, because most free-ranging large mammals in that country had been destroyed, the emphasis in South Africa was on protected areas. Carruthers argued that there was little formal scientific basis for wildlife management in South Africa's protected areas until after the Second World War. She described how, over 70 years, the discipline of conservation biology gradually came to replace an older, veterinary-dominated approach of management interventions that treated large mammal populations like livestock. The former approach was not based on scientific investigation of animal behaviour in nature, but rather in the increase of "… desirable species under controlled conditions of predator or 'vermin' eradication and the prevention of poaching …." (Carruthers, 2007, p. 70). Only in the 1960s, Carruthers said, did scientists begin to engage seriously in the field with living animals. Pringle, in his history of the Wildlife Society of Southern Africa, published in 1982, reported the reluctance of many South Africans, including conservationists, to involve scientists in wildlife management. He pointed out that only in 1950 was the first biologist

appointed to the South African National Parks Board. The prevailing opinion until that time was that sports hunters, who had intimate knowledge of the bush, knew better than scientists how to manage the resource (Pringle, Bond, & Clark, 1982).

This southern African experience was in line with the development of conservation science as a discipline worldwide:

> From its inception until the 1960s, wildlife management in many nations focused primarily on the management of game species. Game management included such activities as the control of predators, the establishment of hunting regulations and the direct manipulation and creation of habitat considered suitable for target species. Since the 1960s, this focus has gradually broadened. In particular, during the last two decades, a convergence of the formerly discrete fields of wildlife biology, ecology and conservation biology has occurred, reflecting a shift in dominant stakeholder groups from hunters to non-consumptive users. (Allen, Cumming, Garmestani, Taylor, & Walker, 2011, pp. 337–338)

Allen et al. go on to say that, even though the paradigm has changed, it is taking time for tensions between single species and ecosystem approaches to become embedded in operations of wildlife management agencies, "… despite compelling arguments for their usefulness" (Allen et al., 2011, p. 339).

Botswana's focus on wildlife as a consumable resource has shaped and coloured most of the scientific research generated within the country, with the possible exception of amateur or popular natural history investigations. In the 1980s and 1990s, the convergence that Carruthers (2007) and Allen et al. (2011) would later describe resulted in development of the ecosystems approach that looked in detail at the complex relationships among animal and plant communities and proposed research-based adaptive management. The growing influence of this disciplinary evolution, of multilateral environmental agreements, and of the popular international conservation movement, bought more conservation biologists from other countries to study Botswana's wildlife in the 1990s and 2000s. This shift in scientific approach, accompanied by an apparent bias of interest that favoured studies of highly visible and charismatic species, either in their role as key players in natural systems, or for their existence value, has helped define the current perception of wildlife research in northern Botswana.

2.4 Wildlife survey work in northern Botswana 1960s to 2014

Wildlife research methodology in northern Botswana has been characterised by survey work, in particular, surveys of mammal and bird populations. This section describes major survey work carried out between the years 1960 and 2014, documenting the involvement of multiple stakeholders and, as

far is it is possible to ascertain from available sources, interactions among them. The section includes excerpts from both primary and secondary sources: although these are sometimes lengthy, they are included both because they help to explain the evolution of the country's wildlife management approaches in the context of how researchers were defining problems, and because the evidence in the original sources is not yet in electronic form and therefore not readily available to other researchers.

2.4.1 The need to address decline: survey results as evidence

The recognition of wildlife population decline, which is a repeated theme in the literature during this period, is accompanied by repeated calls for more, and better, surveys. Counting animals has been considered fundamental to developing wildlife management approaches in Botswana. DWNP Wildlife Biologist, J Carter, in 1982 said plainly:

> The level at which wild animals are utilised is important; ideally this should be the same as the rate at which they produce extra animals into the population. By counting the number of animals and knowing how fast they reproduce, the maximum quota for that population can be calculated. (Botswana Dept. of Wildlife and National Parks, 1982, p. 78)

Wildlife population surveys have also been used to determine the boundaries of protected areas. Mateso Bolaane's study in 2005 of the foundation of the Moremi Game Reserve in northern Botswana, provided an example of the early seeking out and use of such surveys in the region. Local conservationists, including Batswana traditional authorities, founded the multi-racial and cross-sectoral Fauna Preservation Society of Ngamiland in 1963 that led to creation of Moremi Game Reserve. Awareness of the need for research to support such conservation interventions, Bolaane (2005) said, came from international influencers:

> From the outset, international conservation groups were involved in fundraising. So too were IUCH Africa Special Project researchers, such as Riney and Hill[2], who attended the first Fauna Society meeting and undertook an ecological survey. They had come to advise the Bechuanaland Protectorate government on wildlife management, and were concerned about lack of communication between government departments, and externally. They suggested that wildlife should be integrated into mainstream development strategies, emphasized how Kenya had benefited from its wildlife, and underlined increasing global interest as well as the great need for research into diseases of wild and domestic animals. Their report was favourable to the formation of a game reserve within the framework of the BaTawana Tribal Authority and felt it was a realistic way of maintaining and further promoting local interest in conservation. (Bolaane, 2005, p. 254)

[2] Riney and Hill were working on the third stage of the joint IUCN/FAO Africa Special Project (Curry-Lindahl, 1969; Riney & Hill, 1967).

Alec Campbell (1973), however, had expressed concern that the boundaries of Moremi Game Reserve, like most of the protected areas in Botswana, had been established without reference to sufficient research.

> The majority of National Parks and Game Reserves in the Republic of Botswana have come into being, not as the result of careful planning, nor on the basis of ecological research, but from the accidents of history and circumstances obtaining at the time of their inception. … Thus it was that, by 1966, approximately 80,000 sq km of land had been protected as game reserve without any research having been carried out and with no ecological understanding of the areas concerned. (A. C. Campbell, 1973, p. 7)

Creation of protected areas without reference to scientific research was common in African countries, and, combined with lack of consultation with local people, led to management challenges as time passed (Adams & McShane, 1992, p. xv; Carruthers, 2007, p. 66; Gibson, 1999, p. 27; Moleele & Ntsabane, 2002, p. 27).

In 1958 Ansell had reiterated earlier calls for more wildlife research in the southern African region, saying "…we have not yet by any means completed the 'exploration and cataloguing stage' as far as African mammals are concerned" (Ansell, 1958).

Campbell (1973) claimed that no systematic research had been carried out at least until 1965 when Botswana's first wildlife ecologist was appointed. Then, according to Alec Campbell, the country was moving too quickly to declare protected areas without sufficient evidence to establish locations and boundaries:

> By the end of 1967, three research projects were well under way: the Botswana Mammal Survey, an Ecological Survey of the Chobe National Park and surrounding areas, and a survey of the Migratory Herds of the Nxai Pan and western Makgadikgadi Pans areas. These were to be followed by a survey of the hides and skins industry in western Botswana, an ecological survey of the Moremi Wildlife Reserve […], an analysis of hunter and trophy dealer returns, an examination of the importance of pans for desert game, a wildfowl survey of Lake Ngami, study of the importance of mineralized waters in stabilizing desert game, and many lesser surveys. Owing to the shortage of both time and staff, rapid techniques are employed in examining and relating the broad trends in wildlife populations to the status of vegetation and to trends in essential conservation values … Although valuable information is being gained, it is still not secured fast enough, and the promulgation of parks and reserves has continued without the backing of sufficient, or in some cases any, research. (A. C. Campbell, 1973, p. 12)

The 1960s and 1970s began a period of intensification of research into wildlife populations in northern Botswana, generating calls for further, more detailed investigations to support management. Tinley's

1966 ecological study of Moremi Game Reserve recommended detailed studies of large mammal migration routes, the value of veterinary fences and boreholes drilled for wildlife, the relationship of large vertebrates to vegetation, zoonoses, fire control methods, and more use of aerial surveys and vegetation monitoring (Tinley, 1966, pp. 134–135).

Graham Child produced the *Ecological Survey of Northeastern Botswana*, a two-year long study carried out at the request of the Bechuanaland Government and supported by the Food and Agriculture Organisation of the United Nations (FAO) to:

> … advise the Government of and formulate realistic plans for the conservation and utilization of Bechuanaland's game herds. To survey the Chobe Game Reserve and the surrounding game areas with a view to determining what conservation measures should be adopted, planning the development of the reserve as a tourist facility, ascertaining the permissible annual game harvest and investigating the prospects of game ranching. (G. F. T. Child, 1968, p. 1)

Child's report mentioned that the scope of the study was later somewhat modified beyond a strictly utilitarian approach to consider ecological considerations and recommended that the Game Department "… continue to encourage biological research…" and provided detailed suggestions for a code of conduct for visiting wildlife researchers, including provision of workplans and periodic reports to the government. To these he added:

> … the need for retaining in an accessible form, useful observations, which a research worker may not wish to publish himself, but which may be valuable to others. The Botswana Game Survey cards, on which selected members of the public have contributed to the knowledge of the fauna, could readily be adapted for this purpose. … need for a small organisation housing the documented results of past surveys and investigations, in order to save duplication. A great deal of work has been undertaken by people in a variety of disciplines from time to time, since the first missionaries entered what is now Botswana, but their writing are difficult to trace, even when they are known. This disadvantage has been expressed by members of at least two Government Departments and it is to be hoped that the recently established Government Archives, or some similar organization, will be able to cater for this need. (G. F. T. Child, 1968, p. 126)

The 1977 final report of the FAO/UNDP project that supported Child's survey endorsed plans for changes to hunting regulations and recommended better capture and use of hunting data, as well as continuation of aerial surveys, "… to establish and refine hunting quotas" (Food and Agriculture Organisation of the United Nations & United Nations Developmen Programme, 1977, p. 25).

Graham Child was also known for his belief that stewards of the land should be directly involved in the management of natural resources, and to benefit directly from their use (B. A. Child & Child, 2017).

This point of view refected a growing recognition in the 1970s and early 1980s that availability of wildlife for ongoing use depended on integration of its management with land use management. Creation of Wildlife Management Areas (WMAs) as buffer zones between parks and cattle grazing areas was one outcome of this understanding (Richter, 1976, p. iii).

Following the early ecological surveys initiated and supported by external organisations, in 1973 the DWNP reported that it intended to invest internally in wildlife research:

> Like most other countries many of Botswana's wildlife policies have been initiated and dictated by expediency, politics and economics. It is a prerequisite of wildlife utilisation that it should be founded on proper research and not initiated on an ad hoc basis. To such an end a small research section has been started within the Department. It is only now that positive information on wildlife populations, their movements and their habitats is being obtained. Ecological, biological, behavioural and census surveys are under way. In particular, valuable information is being gained from an evaluation of hunter and trophy dealer returns for the basis of the future overall national hunting programme. Research on buffalo was commenced in 1971 and in 1972 the programme, largely financed by the Southern African Nature Foundation, will be extended to include Elephant, thus covering the two major species of the North. The Botswana Mammal Survey, undertaken seven years ago […] has now been published and other visiting research workers are providing valuable information to swell the knowledge being accumulated by the Department's staff. It must be emphasised, however, that the volume of research work presently being carried out is insufficient and much more needs to be accomplished before a really satisfactory conservation programme can be assured. (Botswana Dept. of Wildlife and National Parks, 1973, p. 2)

From 1973 to 1976, the FAO's *Wildlife Management and Utilization in Botswana* project included a survey of elephant in northeastern Botswana to "… determine the number, distribution and movement patterns … with a study of the vegetation of the Chobe National Park and the impact of elephants on the tree and shrub layer" (Sommerlatte, 1976, p. 1). The work, carried out with the DWNP, and partly funded by the Southern African Nature Foundation, recommended that the population of elephants in Linyanti and Chobe be reduced by approximately 30 percent to preserve the vegetation. The report also recommended that monitoring in the area be continued, and that specific research about reproductive status be carried out:

> … surveillance and monitoring of the plant and animal community remains a vital research objective. It is as vital in the Chobe National Park to preserve a threatened Acacia community as it is to preserve a certain population of elephants. the one objective does not rule out the other. (Sommerlatte, 1976, pp. 66–67)

At the Fifth Regional Wildlife Conference for Eastern and Central Africa, hosted by Botswana's DWNP in 1979, Botswana reported that the Countrywide Animal and Range Assessment Project, as

well as several ecological surveys, were underway, and that a long-term monitoring programme for important wild animals and their range was under consideration for inclusion in the 1975/85 National Development Plan. Planned research focused on protected areas, but the DWNP expressed concern that resources might not be available to carry this out. The Department reported that launching of the Tribal Grazing Land Policy in 1974 had made it necessary to re-think the government's wildlife management programme, and that creation of Wildlife Management Areas should help protect wildlife by providing buffer zones between parks and reserves and cattle grazing areas (Nchunga, 1980b, pp. 32, 34). It was this decision, Clare Gupta (2013) argues, that led to future human-wildlife conflict in northern Botswana because the WMAs inappropriately incorporated land that should have been used to support livestock. She attributes government interpretation of the policy to the WMAs beyond the intended use by remote area dwellers to the influence of expatriate conservationists (Gupta, 2013).

The further wildlife declines of the late 1970s and early 1980s were in part the result of drought, increased commercial cattle ranching and partly of introduction of the Unified Hunting Regulations in 1979, which created low-fee Special Game Licences for subsistence hunting by citizens. Local people often sold their licences to recreational hunters, who used them to increase their quotas. These 'package' licences, allowing hunting of the same animals in every part of the country, did not make reference to existing surveys, to acknowledge the differences in the distribution of species (Kalahari Conservation Society, 1995, p. 83).

Moyo et al. (1993) described how drought in Botswana in the 1970s and 1980s was a driver of environmental management research and subsequent policy:

> The report of the United Nations Environment Programme (UNEP) Clearing House Technical Mission to Botswana in 1983 led to further government-sponsored public debate on the management of Botswana's environment … and the first steps towards the formulation of a National Conservation Strategy (NCS). This important document was seven years in gestation and was presented to Cabinet in 1990. (Moyo, O'Keefe, & Sill, 1993, p. 34)

The drought of 1979 to 1983 coincided with observations of the effect of veterinary fences on migrating wildlife. The death of thousands of wildebeest along the fences was documented and publicised internationally by American wildlife researchers Mark and Delia Owens (Owens & Owens, 1985), and by South African journalist Rick Lomba (Lomba, 1986), who made a film that included the wildebeest die-off. Their implied criticism of the cattle industry protected by the fences, and

international embarrassment of the Botswana Government resulted in cancellation of the Owenses' research permits:

> The Owenses never discussed conservation priorities with the government of Botswana, nor did they seek to involve local people in scientific research or to train them in modern techniques for using natural resources. The result was first-rate scientific work of practically no conservation value. The Owenses set up camp in a dry riverbed in the northern part of the Central Kalahari Game Reserve called Deception Valley, and began studying the region's lions and brown hyenas. Until the wildebeest began dying along the fences the Owenses had no contact with Botswana's government except to obtain work permits. It takes a great deal of time to collect data on the social behaviour of desert lions and brown hyena in order to qualify for a PhD, and in reality this was the primary goal. (Adams & McShane, 1992, p. 144)

A Maun-based researcher remembers this period:

> *"Doug Williamson was based in the Deception area in the 1980s after the Ownenses. He was studying the wildebeest die-off. I asked him how he could take photos of all those dead animals and not feel anything. He said, 'My job, I am just a scientist, I just document.' ... Then along came Rick Lomba, the missing link in the chain. Lomba made a controversial film, The Gardeners of Eden, about the event. There was a launch of the film at a KCS meeting, and after the first few minutes of the film some people got up and left. The government was so upset it employed a PR firm, Hill Norton, to pump information back into Europe. But Lomba wasn't intimidated: he just took the film to Europe to show to the European Parliament. KCS was embarrassed. Lomba died prematurely. He was a real investigative journalist. His mission in life was to get a few wrongs righted."* **[G011]**

Such interactions between the Government of Botswana and researchers – especially foreign researchers – did little to build trust and willingness to engage further in the uptake of research.

The issue of the veterinary fences generated a substantial body of research carried out between 1980 and 2014, beginning with the Williamsons' surveys that were sponsored by the Frankfurt Zoological Society (Williamson & Williamson, 2012). Some 40 reports and commissioned studies, at least two dissertations, and many scholarly articles followed.

In 1980 the DWNP formulated a work programme for its Research Division, setting out the following objectives:

1. to provide baseline data on wildlife populations and their habitats (Inventory);
2. to develop a monitoring system for the major animal population;
3. to develop a habitat monitoring system for the areas under the department's control;
4. to investigate the dynamics of wildlife systems with special emphasis on herbivore-habitat interactions;

5. to collect and analyse wildlife utilisation statistics;
6. to identify management options in the different area [sic] under the department's control and make appropriate recommendations;
7. to monitor the effects of management options, especially wildlife utilization schemes, e.g. in WMAs;
8. to advise on privately sponsored research where such research fits into the framework of the Department's and research and/or management objectives (Nchunga, 1980a, pp. 1–2).

The proposed work plan pointed out that Chobe, Ngamiland and Central districts had "… yet to have any proper animal inventory work done…", and that habitat inventory work was still needed in these areas. It proposed that a Senior Range Ecologist, once recruited, would carry out a collation of existing inventory work and work to fill any gaps. The research programme would also build on the work of the Countrywide Animal and Range Assessment Project to carry out an integrated monitoring system for "… major wildlife populations in terms of such parameters as distribution, abundance and condition". The plan also identified priority species, and important habitat issues, for study, and included hunting statistics as a source. (Nchunga, 1980a, pp. 3–4).

The 1980s also saw the DWNP pay attention to the need for uptake and understanding of survey and research requirements by officials at district level. At least four conservation seminars were held by the Department, between 1982 and 1988, to:

> … provide District decision-makers with background understanding of some basic ecological principles. This should put them in a stronger position to have discussions with specialists in various fields. It should also equip the District decision-makers to seek and use advice from specialists, so that development projects can be planned in such a way that optimum sustained use is made of natural resources. Furthermore it should give specialists a better understanding of the needs of District decision-makers, so that they can give appropriate advice at the right level. (Botswana Dept. of Wildlife and National Parks., 1985, p. 1)

Presentations and discussions at a workshop organised by the Kalahari Conservation Society (KCS) in 1983 reflected a high level of concern about wildlife use, and the growth of the cattle industry. Recommendations of the workshop focused mainly on land use interventions, but included the urgent suggestion that the DWNP and Department of Tourism "carry out research and experimentation to promote wildlife management and income-generating wildlife utilisation on a much enlarged scale" (Kalahari Conservation Society, 1983, p. 98). The report also referred to the role of research in guiding policy:

> The livestock industry is indisputably a traditional, irreplaceable, and irremovable part of society and the country as a whole. However, there is an urgent need to formulate and execute firm policies respecting the control of offtake, and this numbers; to initiate greatly improved management practices; and to listen to Government's own hired expert and scientific advisers regarding the exclusion of livestock from areas both ecologically and economically unsuited for their production. (Kalahari Conservation Society, 1983, pp. 2, 1)

Between 1980 and 1984, the DWNP's Senior Wildlife Biologist, Daniel Moroka, carried out a study motivated by concern about the impact of increasing elephant herds on the Chobe's riverine vegetation, following Melton's report of elephant population increases there. Moroka recommended development of a vegetation and animal monitoring programme for the Chobe National Park (Moroka, 1984, p. 43).

The report of the UNDP-funded, FAO-executed programme of assistance to the Botswana Wildlife Training Centre in 1985 called for a follow-up project to support the government's need for monitoring of wildlife resources though producing, among other outputs:

> … a nation-wide computerised licensing and wildlife information system with guidelines on the use of a computer program for data-base collection on wildlife utilization; and research priorities identification study and elaboration of a Scientific Research Programme for the conservation of renewable natural resources, together with an action plan for its implementation. (Food and Agriculture Organisation of the United Nations, 1985, p. 28)

Arntzen and Veendaal's 1986 report of the Environment-Development Linkages Project that was part of the United Nations Environment Programme (UNEP) Clearing House work pointed out that:

> Past research results are scattered over numerous, often bulky reports and particularly older research was often lost or out of sight. Consequently research results did not play an optimal role in development planning. The EDL project in general and this report in particular aims at improving access to relevant environmental data by development planners, identifying gaps in knowledge and consequently suggesting future research areas, and finally suggesting systematic collection to describe the state of the environment. (Arntzen & Veenendaal, 1986, p. 1)

Their report, which drew on a 200-item bibliography of studies, noted that quantitative data for wildlife were limited, with data collection focused on the larger migratory animals.

The Wildlife Conservation Policy of 1986, developed in the consumptive model to ensure "…more intensive utilisation of the resource on a sustained basis…", based its planned interventions on previous research, stating that, "Our knowledge of wildlife movements and habitats has increased considerably over the past twenty years". These interventions included proposal of a joint research programme by wildlife and veterinary authorities to look into wildlife-livestock interactions, including review of

locations and functioning of veterinary fences, and called for "… careful and continued monitoring of the national herds …" (Government of Botswana, 1986, p. 3,5).

In 1990, Botswana approved a National Conservation Strategy that recommended gazetting of Wildlife Management Areas, upgrading of game reserves to increase protection of wildlife, modifying existing protected area boundaries, preparation of management plans, increased anti-poaching controls, and the execution of wildlife cropping projects for the benefit of local communities. The strategy's policy document included commitment to "… the conduct of research and development programmes … the advancement of environmental data systems …", and recognised "… the need for resources to undertake the special training, R&D, data collection, monitoring and promotional programmes …" (Botswana National Assembly, 1990, pp. 17–18).

The UNDP/FAO Land Resource Assessment for Land Use Planning programme included a 1991 evaluation of land for wildlife utilisation. One motivation for the study was Botswana's "… strong commitment to implementing a rational policy of wildlife utilisation involving local communities and private ranchers, still, however, with a strong element of central control" (Rodgers, 1991, p. ix). The study's report recommended that, recognising conflicting interests, future land use planning for wildlife should be preceded by a review of biodiversity goals and objectives, and development of a system of subsidies similar to those for the livestock industry (Rodgers, 1991, p. 86).

2.4.2 Monitoring methodology as a discussion point

Aerial survey technology provided the capacity to count wild animals efficiently, compared to laborious ground surveys. Aerial census data for large mammals were collected by the DWNP between 1975 and 2014, with a break between 1997 and 2010.

The 1978-79 aerial surveys carried out by DHV Consulting Engineers on behalf of the then Department of Wildlife, National Parks and Tourism set the scene for further research, saying:

> The survey data provided much practical insight into the distribution, and some of its determinants, of large herbivores. Nevertheless, it is important to appreciate the reservation made in Report IV, that a survey of the whole Kalahari by a few people during only one year cannot but lack in detail. Many of the animal-range relationships pointed out are therefore informed speculations rather than well-established facts. A second major limitation is not inherent to the scope of the investigation. The Kalahari is a large dynamic system. Associations of today between animals and certain segments of the range may change in the future. This underlines the need for periodic assessment. (DHV Consulting Engineers, 1980, pp. 85–86)

The three aerial surveys in 1984 and1985 were carried out over northern Botswana in both wet and dry seasons by the Kalahari Conservation Society.

In his 1987 aerial survey of large mammals for the Botswana Dept. of Water Affairs' Southern Okavango Integrated Water Development Study, Larry Patterson reported:

> Previous information on animal numbers in the Okavango Delta is both scanty and extremely crude. Most of it is also at least ten years old and was collected during an almost unprecedented wet period. This is in marked contrast to the present dry or drought conditions, i.e. the habitats used by many species have changed dramatically. Changes may be qualitative, e.g. different forage composition or characteristics, but more importantly they are quantitative in the sense that certain habitat types have expanded and others contracted. (Patterson, 1987, p. 1)

The European Commission supported aerial surveys carried out from 1989 to 1991 by the firm, Bonifica, to:

> … provide the Research Division of the Department of Wildlife and National Parks with assistance in the establishment and operation of a refined aerial survey programme for the countryside monitoring of wild animal populations to determine numbers and movements on a long-term basis. (Bonifica, 1992, p. 4)

The report of the survey summarised the motivation for institutionalising the aerial survey work in the DWNP. It explained that reactions to the death of significant numbers of migratory animals along fence lines during the drought period of 1982 to 1988 "… renewed awareness of the need for information on which to base a rational approach to the problems involved, resulting in the setting up of a permanent wildlife aerial monitoring programme" (Bonifica, 1992, p. 3). Another motivation the report said, was a perceived increase in elephant populations and the government's consideration of a cull. This did not align well with the international movement to consider elephant an endangered species, so Botswana needed evidence that its elephant population was "… large and unendangered" (Bonifica, 1992, p. 3).

In the mid-1990s there were still calls for more basic wildlife research in Botswana. Dangerfield wrote:

> … hundreds of species in Botswana have yet to be described by taxonomists. … Despite the lack of inventory information, *in situ* conservation of biodiversity in Botswana has considerable potential, thanks to strong legislation which includes a Flora and Fauna Preservation Act and a National Conservation Strategy, together with a suite of National Parks, Game Reserves and Wildlife Management which, when fully gazetted, will account for some 36% of the land area. However, some key habitat types … are not included in these protected areas and there are some concerns that, although sound, the conservation legislation may not be implementable locally. (Dangerfield, 1995, p. 277)

Wheelwright and others were also critical of the DWNP's monitoring methods, arguing that its research strategy's emphasis on counting large mammals without adequately considering ecosystem processes and the need to understand the "… behaviour and basic biology of animals of concern" was a problem:

> Counting the number of individuals present in a population at a particular time from an airplane cannot provide sufficiently detailed demographic data to identify critical life history stages and the causes of variation in in population growth rate, predict population trends or responses to perturbations accurately, or enable effective management. (Wheelwright, Dangerfield, Flyman, & Tjibae, 1996, p. 3)

The DWNP's concern about increasing elephant populations in the Chobe area prompted a study of the application of ageing methodology by Cynthia Moss in 1991. That study found "… a healthy, growing population which appears to be one of the few populations in Africa which has not been seriously affected by poaching and/or culling activities" (Amboseli Elephant Research Project & Moss, 1991, p. 1). The European Community commissioned another study of the impact of elephant on vegetation in the Chobe River area from 1993 to 1995, this time making considerable use of aerial photographs and remote sensing images. The study identified wild fires, rather than elephant, as the major cause of degradation, and recommended further research about vegetation succession, and development of a fire management plan (Gulinck, 1995, pp. 57–58). The Chobe's large elephant herds continued to be raised as a management issue, resulting in many studies, including the five year BONIC collaboration between DWNP and several Norwegian institutions, that found no significant ecological impact on vegetation by elephant (Skarpe, 2002, p. 2).

2.4.3 Building national research capacity

The DWNP 's Research Division was active during the 1990s, producing its first research strategy (Botswana Dept. of Wildlife and National Parks, 1993), and a series of annual progress reports (Botswana Dept. of Wildlife and National Parks Research Division, 1994, 1995b, 1995a, 1998). These reports, which included descriptions of independent research as well as that carried out by the Department, were organised using the goals of Botswana's National Development Plan 7 (called NDP 7) for a wildlife research agenda:

1. Development of the wildlife population survey, including a baseline inventory on wildlife populations and habitats, and monitoring changes;
2. Research into wildlife management problems (including the elephant population), provision of water for wildlife, and the incidence and control of livestock predators;

3. Research into the ecology of specific species and communities. This research will include the coordination of privately sponsored wildlife studies to ensure consistency with national objectives;

4. Studies of factors affecting wildlife utilisation, such as game fencing and trophy animal offtake strategies; and

5. Research into wildlife disease control, such as veterinary restrictions on the movements of wildlife and wildlife products, which constrain effective wildlife utilization (Botswana Dept. of Wildlife and National Parks Research Division, 1994, pp. 1–2).

NDP 7 also stated that, "In order to store the results of the research and monitoring effort, a computerised service unit will be developed. As well as storage of biological and socio-economic data, this unit will serve other functions, such as storing licence details" (Botswana National Development Bank, 1991, p. 306).

Shortly after issuing its first wildlife research strategy in 1993, the DWNP proposed development of an internationally-funded Botswana Wildlife Research Institute to be based in Kasane, to "… generate the scientific understanding needed for optimal management of the wildlife resource and its habitats within Botswana. This includes maintaining a leadership role in questions of scientific understanding of wildlife resources shared with neighbouring countries" (Botswana Dept. of Wildlife and National Parks Research Division, n.d., p. Appendix II). The proposal stressed the strategic value of locating the institute at an important location for wildlife that migrated across international borders and submitted that a key function of the institute would be to develop regional research strategies. The institute was not created, perhaps because the Okavango Research Centre was established in Maun, but the importance for wildlife management of the international borders along the Chobe-Zambezi continued to be recognised through subsequent programmes such as Four Corners and the Kavango Zambezi Transfrontier Conservation Area (KAZA).

Botswana's focus on conserving and developing wildlife as a renewable resource in the 1970s and 1980s, particularly through hunting, made the importance of monitoring wild animal populations clear, and motivated the DWNP's efforts to gather and process available data:

> In 1985 to early 1991 DWNP, with management assistance from the Kalahari Conservation Society, developed the computerised Hunting License System (CHLS) to more effectively manage hunting licenses within Botswana. The CHLS project was subcontracted to Ngami Data Services in Maun, and in March 1991 the CHLS was handed over to DWNP and moved from Maun to DWNP's Headquarters in Gaborone. Except for 1993 the CHLS has provided

> valuable hunting statistics and has highlighted procedures that could be tightened up. (ULG Consultants, 1996, p. 1)

The 1996 report of the computer expert assigned by the European Development Fund's Wildlife Conservation in Northern Botswana project described how the expert, finding the CHLS not functioning, got the system working again and produced the 1994 statistics. These data revealed "… areas of concern such as oversells and sales of species in an area without a quota" (ULG Consultants, 1996, p. 7). The expert reported these issues several times to the Regional Wildlife Officer responsible for licensing between 1994 and 1995, apparently without any action from the Department:

> Having had no success in persuading the RWO Licensing to review Licensing procedures the CE [computer expert] produced a discussion document on 'Upgrading the Present Licensing Systems' … and presented it to the Deputy Director and Departmental Computer Steering Committee. The CE continued to push for the review of the Licensing procedures through the Departmental Computer Steering Committee and Project Steering Committee. In March 1996 the Deputy Director took up the CE's recommendation and formed the project team to review Licensing. The CE drafted the terms of reference for the Licensing Project Team … and the first meeting was held in April 1996. Significant progress has been made in documenting Licensing procedures, but there is still a lot of work to be done to revise and implement these procedures. (ULG Consultants, 1996, p. 8)

A listing of existing research about wildlife in the Okavango region, compiled by Mark Murray for the Permanent Okavango River Basin Water Commission (OKACOM) in 1997, pointed out that:

> Many studies on large animal populations have been undertaken by the Department of Wildlife and National Parks (DWNP) while private research (mainly as part of dissertation studies) has played a very important role, particularly in collecting information on large mammals, fish and fisheries. Both research and population censuses have tended to focus on the larger, commercially important or rare and endangered species. Few data have been collected on species of low tourism, hunting or other commercial value in the Okavango Delta region. (M. Murray, 1997, p. 1)

Murray's report identified many research gaps and the need for monitoring. His recommendations for further studies for mammals included systematic annual aerial monitoring of large mammal distribution and population estimates, systematic survey flights covering selected habitats during transitional phases in the annual flood regime, annual stratified random aerial census surveys of important species, population estimates, habitat preference and ranges, breeding and behaviour information for cryptic species, monitoring of key indicator, or vulnerable species and their habitats, high research priority for species causing significant changes to vegetation, floodplain ecotone inter-specific herbivore competition studies, identification of Limits of Acceptable Change for habitat types affected by large

herbivores, and impacts on wildlife species and populations of visitor densities (M. Murray, 1997, p. 31).

Twelve years later, another study commissioned by OKACOM referred again to the lack of available data on which to base indicators of wildlife condition in the context of the river basin's ecology: "Long term ecological monitoring data, and data that link different wildlife to flows, are essential in order improve predictions of wildlife potential response to flow variations" and "Literature highlighting the relations between wildlife and flows, and the impact of flow variation on specific wildlife species of the Okavango Delta is largely scattered, and unassimilated." (Bonyongo, 2009, pp. 3, 24).

A set of national biodiversity indicators developed for the Botswana Department of Environmental Affairs (DEA) in 2011, as part of as part of a regional capacity building project called *Biodiversity Indicators Capacity Strengthening in Africa* (BICS-Africa) and led by UNEP-World Conservation Monitoring Centre (WCMC), used the international standard Pressure-State-Response framework that incorporates causal factors. Development of the indicators was carried out with participation of stakeholders, including researchers from academia and NGOs, as well as government agencies, during two workshops. The indicators included such measurements as *Poaching incidents* (Pressure indicator), *Biomass of large ungulates (*State indicator*), and Extent of protected areas (*Response indicator*).*

> During the BICS-Africa project it became apparent that very little knowledge about biodiversity indicators existed amongst stakeholders. The few indicators that had already been developed were not being used or reported on and were, therefore, not serving their intended purpose. It was also evident that the country had not provided sufficient resources for biodiversity monitoring. It is hoped that the publication of this booklet will demonstrate the value of biodiversity indicators in policy making and catalyze the allocation of resources towards biodiversity monitoring. (Botswana Dept. of Environmental Affairs, 2011)

While many of the indicator areas meant to be compiled at national level that were mentioned in the 2011 guide were covered in the 2014 *Protocol for the Okavango Wildlife Monitoring System*, the Protocol did not make direct reference to the 2011 guide (Bourquin & Brooks, 2014). Botswana's *Forest Conservation Strategy* released in 2011 also included one of the indicators as the DEA set, but did not cite the document (Forest Conservation Botswana, 2011). Botswana's *National Biodiversity Strategy and Action Plan*, revised in 2016, reflected the 2011 indicators, but announced changes to some of them (Botswana Dept. of Environmental Affairs, 2016). In the same year, Statistics Botswana's report, *Botswana Environment Statistics 2016*, included several sets of data that appear to

reflect the 2011 indicators, but do not mention the source (Botswana Statistics Botswana, 2017). A workshop held by Statistics Botswana in 2016, *Stakeholder Consultative Workshop On Environment Statistics*, did not mention the 2011 indicators, but reported that the DWNP and DEA committed to supplying datasets: some of these appeared to reflect some of the indicators (Botswana Statistics Botswana, 2016). These policies and government reports at Botswana's national and regional levels, released since 2011, made reference to the DEA's national level indicators, but, with the exception of outputs related to the elephant population debate, my review of published research outputs from the period 2011 onward revealed no mention of them. So, for the most part, while some researchers were clearly seeking and using available national datasets related to the indicators, such as aerial census, poaching incidents, and Problem Animal Control data, they were not interpreting their research findings with reference to the indicators. In other words, the indicators were not part of an ongoing exchange of knowledge that could be interpreted as boundary work[3].

At the 1997 national conference, *Strategies for the 21st Century*, Sedia Modise of the DWNP outlined management challenges faced by the Department, and made recommendations for more integration of conservation and development programmes, better enforcement, and international joint management. He also called for results of research to be "filtered back" to management to facilitate sound decision-making, and an effective monitoring and reporting system that tracked progress on objectives for species and habitats (Botswana Dept. of Wildlife and National Parks & Kalahari Conservation Society, 1997, pp. 77–78).

At the same conference, a discussion of Monna and Sebina's presentation about Botswana's planned environmental impact assessment (EIA) legislation raised the issue of research skills:

> A commentator pointed out that there is not enough skilled manpower in Botswana to carry out EIAs and as such international organisations come into the country to do research and then leave with the results. These organisations should not be allowed to do so. This raises the question of property rights and ownership and the need for capacity building in Botswana. However, the Chairperson observed that most studies carried out in Botswana are instituted by the government, with government knowledge, and as such most of the results do remain in the country. (Botswana Dept. of Wildlife and National Parks & Kalahari Conservation Society, 1997, p. 201)

[3] Boundary work refers to the processes and activities intended to mediate between knowledge and action (Clark et al., 2010). Boundary objects have been described as "scientific objects which both inhabit several intersecting social worlds and satisfy the informational requirements of each of them" (Star & Griesemer, 1989). Boundary spaces are places where actors can share, transfer and translate their knowledge into joint knowledge (Stange et al., 2016).

The issue of limited scientific capacity within the department was addressed in 1998 through the Botswana Norway Institutional Cooperation and Capacity Building Project (BONIC), designed to improve the preconditions for management of wildlife resources The five-year project was based on cooperation among the DWNP, the Norwegian Institute for Nature Research (NINA) and the Centre for International Environment and Development Studies (Noragric) at the Agricultural University of Norway. The project aims were to provide formal and informal research training to DWNP staff (7 MSc and 4 PhD students), to carry out research that improved understanding of ecosystems in northern Botswana and systematic changes taking place, and to encourage and facilitate the use of the improved knowledge and staff capacity by DWNP in the management of wild natural resources (Skarpe et al., 2004). The project resulted in at least two DWNP researchers obtaining PhD degrees and returning for a time to their government posts.

2.4.4 Engaging regionally

A growing awareness of the need to study Botswana's wilderness as part of a mosaic that was linked to managing the environment across the country's own regions and in neighbouring countries was reinforced by transboundary projects that brought engagement with more stakeholders.

Talking in 1997 at a national symposium about the USAID-funded Natural Resources Management Project, which began large scale funding for Community Based Natural Resources Management (CBRM) programmes in Botswana at the end of the 1980s, the DWNP's Kukame Ngwamotsoko said:

> … despite the knowledge of and publicity about NRMP, the wildlife managers have difficulties in pushing for wildlife management at policy level. It is perceived that wildlife is abundant and much effort is being expended on conservation and management of existing wildlife. (Botswana Dept. of Wildlife and National Parks & Kalahari Conservation Society, 1997, p. 184)

Major wildlife survey projects carried out in the new Millennium included the African Wildlife Foundation, USAID-funded, Four Corners Transboundary Natural Resources Management Area (TBNRM) Initiative, designed to provide planning information for cooperative economic use of the region's natural resources by Botswana, Namibia, Zambia and Zimbabwe (Zambezi Society & Biodiversity Foundation for Africa, 2004).

The TBNRM project, with its focus on biodiversity monitoring, reviewed the historical wildlife survey data available for the region, and reported that, " … it can be seen that we know a significant amount about mammal and birds, and about the general biodiversity of the Caprivi Strip, Okavango Delta and

north west Zimbabwe, but very little indeed about invertebrates, or about biodiversity in Angola" (Timberlake & Childes, 2004, p. 3). The project's study of the degree of local community participation in in wildlife monitoring reported that none of the areas studies had "…complete or valid estimate of wildlife numbers, health or diversity" (Boggs, 2003, p. 46), and called for more involvement of local communities in wildlife census, monitoring and quota setting work. Overall, the TBNRM reports recommended a comprehensive research and management plan that would include long-term and on-going biodiversity surveys and taxonomic research (Zambezi Society & Biodiversity Foundation for Africa, 2004, p. 250).

Even with the volumes of information resulting from earlier studies, the move to produce management plans for Ngamiland's protected areas in the 1990s prompted calls for more data collection:

> … according to IUCN's Ferrar in the Makgadikgadi/Nxai Pan Scientific workshop documents (1994), management plans should not attempt to be compendiums of all existing biological and scientific descriptions'. On the other hand in the case of the Okavango, there are still too many gaps in our knowledge of basics to attempt major interpretations and summaries of data. What is now needed in the Okavango is a second symposium where relevant experts and researchers can pool their knowledge gained since the first meeting in 1976 and synthesize the results after due discussion. (Okavango Community Consultants, 1995, p. 23)

The Okavango Delta Management Plan (ODMP) project was funded from 2004 to 2007 by the IUCN, Danish International Development Assistance (DANIDA), German Development Corporation (DED) and Swedish International Development (Corporation) Assistance (Sida) to help fulfil Botswana's commitments to maintain the Okavango Delta as a Ramsar wetland of international significance. Its objectives included establishing viable institutional arrangements and mechanisms to ensure conservation of the ecological character of the Delta and its sustainable use, and required both compilation of existing research and new investigations (Okavango Delta Management Plan, 2008).

The ODMP project, carried out by an office of the Department of Environmental Affairs in Maun, required involving all the departments of the Ministry of Environment, Wildlife and Tourism in the project's research and consultative processes. This coordination proved to be the biggest challenge of the project, indicating that the interdepartmental coordination problems of the 1960s had not disappeared.

The report of the research strategy proposed for the ODMP project reported:

> Despite the relatively large volume of research that has been conducted in and around the Okavango Delta system since the mid 1960s, many of the research results are very difficult to

> locate. While the results obtained in some research projects were reported formally in the peer-reviewed literature, which is relatively easy to access, much of the research was simply recorded in project reports. This 'grey literature' is notoriously difficult to find since it consists mainly of departmental reports, consultancy reports and university theses, where very few copies were produced. (Ashton, Turner, Jensen, Mumby, & Neergaard, 2006, p. 21)

The research strategy looked at wildlife in the context of its use to tourism, and of its role in threats to community livelihoods through conflict between people and wild animals, such as crop raiding and predation of livestock. The ODMP's commissioned research included only one study of large mammals, a baseline inventory of leopard and cheetah carried out by the NGO CARACAL (Centre for Conservation of African Resources: Animals Communities and Land Use, 2006).

One of the final products of the ODMP was a research and monitoring action plan for work to take place after the end of the project:

> … specifying the activities that need to be initiated and topics that need to be investigated to address current problems and needs, as well as outlining some specific tasks and responsibilities to get these started. It was developed from January to March 2007, involving a series of interviews with ODMP stakeholders as well as two stakeholder workshops, during which the overviews were obtained, R&M needs and priorities identified and activities and responsibilities discussed and decided upon. (Ramberg, Bendsen, Oberthur, & Mfundisi, 2007, p. ii)

Priorities for wildlife research identified by the plan were the impact of consumptive wildlife utilisation on key wildlife species, baseline information on indicator and keystone species, population dynamics of all forms of wildlife and vegetation in relation to climate change, changes of flooding and changes of habitat, and effects of the veterinary fences on wildlife and livestock (Ramberg et al., 2007, pp. 8–10).

Much of the plan was devoted to the issue of monitoring and called for engagement with both communities and the private tourism sector to improve the capture of data.

While several later projects, such as the Global Environment Facility-funded BiOkavango and the USAID-supported Southern Africa Regional Environmental Program (SAREP), followed some of the ODMP's recommended activities, implementation proved to be a challenge. SAREP produced a mid-term review that pointed out:

> The majority of biodiversity-related action items in the plan have not been implemented. Consensus among stakeholders consulted was that ODMP's focus on biodiversity was too narrow - restricted mainly to a few species with no integrated biodiversity program - and that the plan's approach to biodiversity conservation in a flood pulsed system such as the Okavango is not helpful. Additionally, it was noted that the ODMP did not focus enough on

> key issues and processes that would enable the ODRS to be maintained and wisely used as a functional ecosystem. (Chemonics International, 2013)

The review also reported lack of progress on monitoring and research:

> Due to shortcomings in data collection and the absence of detailed (up-to-date) baseline data on biodiversity, status of ecology, and physical functions, results of studies conducted as components of the ODMP framework do not have the depth or the breadth for more comprehensive integration of biodiversity, physical functions, and sustainable use of the Delta's resources. Because the relevant data are not always available, planning and/or management decisions in the ODRS are sometimes made using fragmentary, superficial, or outdated information. Stakeholders are also aware that ODMP's Research and Monitoring Framework implementation will facilitate crossing of organizational barriers where opportunities for collaboration, data, and resource sharing are not yet effectively resolved and/or established. (Chemonics International, 2013)

The Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA), established over the years 2006 to 2012, to combine and maximize the use of protected areas in Angola, Botswana, Namibia, Zambia and Zimbabwe, has generated new research for the region, mainly focused on animal diseases and tourism potential (Botswana Dept. of Wildlife and National Parks, 2014a; D. H. M. Cumming, 2008; Wildlife Conservation Society, 2014).

In 2009 Botswana's National Development Plan 10 set out a programme for wildlife management that included more surveys:

> To address challenges encountered during NDP 9, the sub-sector aims to increase wildlife and fish populations as bedrock for tourism. Aerial and ground counts will be carried out to determine species diversity and populations to provide credible information for wildlife management. Various strategies, such as promoting non-consumptive use of wildlife resources (e.g., photographic activities) and provision of water within protected areas, will promote the growth of wildlife populations. In terms of governance, there will be formulation of new policies and legislation and review of existing ones to enable smooth implementation of the above strategies. The sector will also promote stakeholder participation, including the CBNRM programme, in coordinated and transparent environmental governance. (Botswana Ministry of Finance and Development Planning, 2009, p. 274)

A pronounced increase in the international illegal commercial wildlife trade in the 2000s (Rosen & Smith, 2010) resulted in a series of international meetings and new programmes, and a shift of management away from community empowerment towards law enforcement. Botswana was at the centre of many of the discussions, because of its large elephant populations and the substantial resources the government was devoting to anti-poaching (United States Library of Congress, 2013).

The importance of better monitoring of populations of large mammals targeted by poachers has been increasingly highlighted (Van Aarde & Ferreira, 2009).

In 2014, the Botswana NGO, Elephants without Borders, following wide dissemination of its 2010 joint survey with DWNP, received donor funding to carry out the Great Elephant Census (GEC), an aerial survey of the 20 African countries with remaining populations of elephant (Paul G. Allen Foundation, 2014). In Botswana, this work focused on the Okavango Delta and the Chobe River system, where it found one of the highest densities of elephants of the survey (Chase et al., 2016). Results of the GEC, like those of the 2010 survey, were challenged in Botswana by some other researchers, and subsequently by the DWNP, based on disagreement about the survey methodology used. In the context of frequent reports of undesirable human-wildlife conflict incidents, and of high levels of destruction of vegetation, it was argued that the survey under-estimated the number of elephants in Botswana. The issue came to a political head in 2018, when Elephants without Borders reported a marked increase in elephant poaching in northern Botswana, citing its aerial observations of carcasses (Elephants without Borders, 2018, 2019; Schlossberg, Chase, & Sutcliffe, 2019). The following international media coverage resulted, in the light of a perception that the current government had been negligent in its anti-poaching work, in refutations of the findings in Botswana by government and some independent researchers (Alastair Leithead, 2019; K. A. Alexander, McNutt, & Vandewalle, 2018; de Greef, 2018).

The DWNP issued a revised and updated research strategy in 2016 that reiterated the need for ongoing data collection for wildlife populations: “Collection of better and consistent data on animal numbers, so we do not have to ‘make do’” (Botswana Dept. of Wildlife and National Parks, 2016, p. 20). The same strategy also calls for long-term monitoring of indicator and keystone species, standardized participatory monitoring, special monitoring attention to the Problem Animal Control programme, and development of methodology to enhance effectiveness of monitoring.

2.5 Stakeholder participation in Botswana wildlife research

While the Government of Botswana has been the overall controlling force in wildlife research in the region, setting both management and research agendas, other organisations have also played a role, often channelling funding, advice, and agendas through Botswana government agencies. This section outlines the role of some of these in influencing wildlife surveys and research in the region.

2.5.1 Civil Society Organisations and programmes

The organisations described in this section are included because of their specific interest in, or contribution to, wildlife research. Botswana has some history with voluntary, non-governmental organisations: while it is recognised that most Botswana Civil Society Organisations (CSOs) that address a range of social, legal and developmental issues in Botswana have grown up since the 1990s (Kebonang & Lebotse, 2010), awareness of the country's wilderness areas motivated formation of such bodies much earlier.

A popular conservation movement, drawing mainly from civil society and characterised by increasing visibility of amateur and semi-professional natural history enthusiasts, began in Botswana in the 1960s. This movement saw, as in the case of the formation of the Fauna Conservation Society of Ngamiland in Maun, conversion of hunting and other natural resources exploitation interests to nature appreciation, as well as interest in local customs, language and indigenous points of view. Members of this movement were to play a large part in promoting wildlife research over the following years.

A South African-based association, the Okavango Wildlife Society, was formed in 1964, for people interested in the Okavango Delta and the Kalahari, and to function as an advocate for protection of the region's nature. The Society raised funds to sponsor Tinley's survey of Moremi Game Reserve in 1966 (Tinley, 1966), Biggs' survey of Chief's Island in 1973 (Biggs, 1979), the Kalahari predator research of Mark and Delia Owens in the late 1970s (Owens & Owens, 1985), translocation of white rhino to northern Botswana in the 1970s and 1980s, Lake Ngami studies in 1980, and workshops and conference attendance for Okavango researchers. The Society became involved in protests about potential extraction of water from the Okavango, and erection of veterinary fences in Ngamiland in 1997 (Skjetne, 1997). The Society's newsletters provide narrative reports about these and other research projects it supported over a 30 year period (Okavango Wilderness Society, n.d.).

The Botswana Society was formed in 1967 with the intention of "… encouragement of interest in, and research and scholarship in, the fields of science, humanities, and arts especially when such subjects relate to Botswana" (John Cooke, 2015, p. 96). The Society began producing a journal, *Botswana Notes & Records (BNR)*, in 1968. In the Forward to the first issue, Seretse Khama, President of the country, wrote:

> The amateur has contributed greatly to the knowledge of Africa; but is frequently deterred from making public his knowledge because of the lack of a suitable journal in which to

> publish his knowledge. Normally the choice is between a rather forbidding and specialised scientific periodical and the popular press. This journal tries to bridge the gap by providing a place where matters of permanent interest concerning Botswana can be published. It has no pretensions. If what you have written adds to the knowledge of Botswana, the country and its people we will consider it for publication, whether or not it is written in the jargon of science or in a more homely idiom. In particular it is hoped that officers in the service of the Government of Botswana will make use of the journal to publish something of what they have learned during their period of service in Botswana. (S. M. Khama, 1968, p. 2)

From its inception to 2014, the BNR appears to have been faithful to its founders' intentions. It published a mix of scientific, historical and sociological studies, the greater part non-biological. An analysis of the publication's content carried out as part of this thesis work in 2015 showed that 73 percent of the articles were produced by foreigners, 20 percent by citizens, and the remainder through a collaboration between foreigners and citizens. A possible explanation for the high number of foreigners is that, in the early years of Botswana 's independence, the country depended on many expatriate professionals to help build the civil service.

Fifty-seven percent of the authors were academic scholars, 15 percent government officials, and 14 percent individual members of the public, with the remaining articles contributed by missionaries, NGOs and consultants. The nature of the wildlife research reported in BNR combined professional and amateur natural history observations. Of 149 articles, about 25 percent of the total content, not including book reviews and notes, were categorised as *Zoology and Wildlife* by the publisher, 45 percent consisted of species checklists or behavioural studies, 33 percent were studies of consumptive use or management, ten per cent were ecological studies that looked at the relationship of animals to their environment, and two per cent were studies of disease. Mammals were the focus of 36 percent of the focused animal studies, insects of 31 percent, birds of 12 percent, reptiles of 10 percent, and fish 10 percent. Thus the BNR in the 1960s began a process of attention to individual species studies that was to be picked up by other individual researchers in the 1980s. Studies of smaller animals such as birds and insects, well represented in the BNR, however, were to remain rare among the later studies by international individual researchers.

The Kalahari Conservation Society (KCS) was formed in 1982 on the initiative of Botswana businessman Louis Nchindo, "… in recognition of the pressures on Botswana's wildlife and the general environment …. to create a greater awareness of and to disseminate greater knowledge and information about the country's wildlife heritage and its habitats" (Kalahari Conservation Society, n.d.). An assessment of the KCS' scope of operations in 1995 reaffirmed the organisation's focus on wildlife

within the larger conservation context, and then, in the face of funding challenges, in its 2006-1010 strategic plan the Society adopted a broader, ecosystems approach that incorporated the idea of preservation of biodiversity.

As the only nationally recognised and well-resourced NGO, the KCS almost immediately functioned as a consultancy, conducting and coordinating more than 60 research and conservation projects between 1982 and 2014 at the request of the Botswana government, development aid cooperation projects, and international conservation organisations. The KCS has consistently sought consultancy work to support its advocacy activities. The following partial list of projects[4] carried out or facilitated by the KCS reads like a chronological outline of wildlife management in Botswana.

Table 2-1 Research projects carried out by the Kalahari Conservation Society to 2016

Completion Date	Project
undated	Moremi Mannonye Conservation Trust
undated	Mapanda Conservation Trust
undated	Gwezotshaa Natural Resources Trust
ongoing	Leopard Ecology and Conservation
undated	Makgadikgadi Flamingos
1983	Symposium: Which Way Botswana's Wildlife?
1984	Aerial monitoring of major wildlife species in northern Botswana
1985	The contribution of the tourist industry to the economy of the Republic of Botswana
1987	Ngamiland State Lands Proposed Land Use Plan
1988	Field investigation into the mokoro industry
1988	Workshop on Sustainable Wildlife Utilisation: the Role of Wildlife Management Areas
1989	Ecological Zoning of the Okavango Delta
1989	Proposed Nata Sanctuary
1990	The Future of Botswana's Elephants Workshop
1990	Establishment of an Okavango Research Centre
1991	Moremi Game Reserve Management Plan
1992	Symposium: Which Way Botswana's Environment?

[4] Extracted from the University of Botswana Library catalogue and the KCS website, 31 October 2015

Completion Date	Project
1992	The Botswana livestock industry and the environment
1993	Chobe National Park Management Plan
1995	Symposium: the Present Status of Wildlife and Its Future In Botswana
1996	Funding request for the Okavango Research Centre
1996	Fish stock assessment of the Okavango River
1997	Conservation and Management of Wildlife In Botswana: Strategies for the Twenty First Century : Workshop
1997	National Conference on Women and the Environment
1998	Anti-poaching Unit
2001	Socio-Ecological Survey on the Okavango River Basin
2001	Technical Predator Management and Conservation Workshop in Botswana
2003	Okavango Fish Parasite Project
2003	Secretariat, Botswana for Global Water Partnership – Southern Africa
2003	Assessment of attitudes of selected Batswana towards wildlife
2004	National Workshop on the Convention on Biological Diversity
2004	Conservation and Development Opportunities from Sustainable Use of Biological Resources in the Communal Lands of Southern Africa Project
2005	Desert Margins Project study
2006	Decommissioned Fences Project
2007	Every River Has its People Project
2007	CBNRM Secretariat
2007	Local Governments and Integrated Water Resources Management in Southern Africa (LoGo) Water Project
2008	HIV/AIDS-Environment Working Group (HEWG) Joint Programme
2009	Hunting and the Future of Wildlife Conservation in Botswana
2010	Stakeholder analyses for OKACOM, ORASECOM
2012?	Water Provision Project for the Makgadikgadi Game Reserve
2012	Zambezi has its People Project
2012	Documentation and Awareness Creation on the Conservation Trust Fund Activities and Projects in Botswana

Completion Date	Project
2012	TFO research project (2012/4); Stakeholder involvement in research to significantly contribute towards sustainable management of the Okavango River Ecosystem
2013	KCS/DEA National Biodiversity Strategy and Action Plan 2.0 (2013/5): Mainstreaming Biodiversity in Development Policy and Planning Initiative
2014	KCS/DWNP Northern Botswana Human Wildlife Coexistence Project (2014/5): Identification and demonstration of comprehensive solution to HWC that is supported by rural communities
2016	CS/Oxfam ASSAR Research-in-Use partnership (2016/7): Influence climate change adaptation practice and policy through sharing of research findings and recommendations

Fulfilling at the same time the multiple roles of official advocate, stakeholder, consultant and source of expert opinion, the KCS is perhaps the most important civil society organisation in Botswana's wildlife research environment, and deserves fuller study.

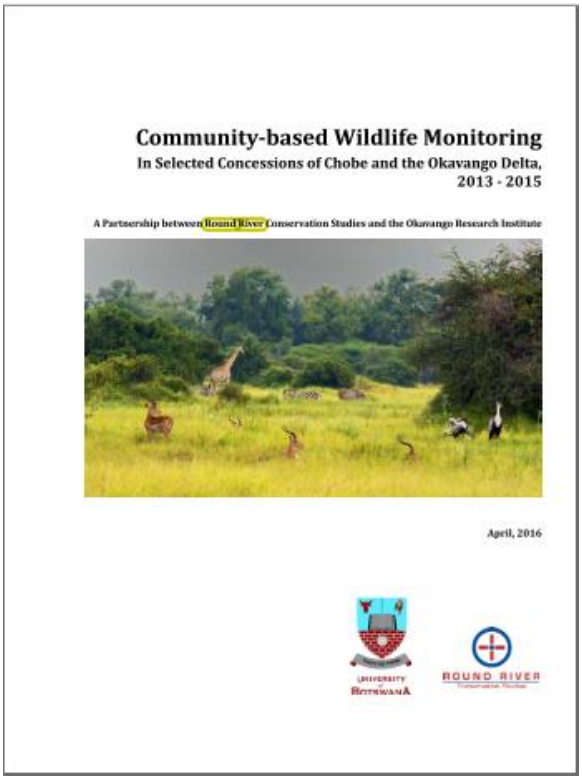

Figure 2-2 Monitoring report produced by international NGO, university, and community escort guides

Round River Conservation Studies is an example of recent efforts to engage a cross section of stakeholders in wildlife data collection. A non-profit organisation based in Bozeman, Montana, USA, it carries out field surveys in different parts of the world, funding its work through engaging fee-paying students who participate in the fieldwork as a study-abroad learning process. The organisation began working in northern Botswana in 2013 in partnership with the Okavango Research Institute to carry out ground transect monitoring to complement activities of the existing Management Oriented Monitoring System (MOMS) programme, and in line with the recommendations of the USAID-funded SAREP work that developed monitoring guidelines for private sector tourism guides (Bourquin & Brooks, 2014; Round River Conservation Studies, 2016). The programme, which included counts of large herbivores, birds and some vegetation species, was designed to include community escort guides already responsible for carrying out the MOMs work. It was an exercise in experimentation with ground

transect methods, and in further developing the skills of the escort guides. In 2016, a report compiled jointly by Round River and the Okavango Research Institute reported the results of five years of the work, reviewing the methodology. The report stated that data collected through the work were "… marginal or insufficient to provide reliable estimates of density or demographics for most or all species of interest. We calculated an estimate of effort, measured in survey length, required for key species to achieve desired levels of variation based on the data collected in the 2015 dry season …." (Heinemeyer et al., 2016, p. 29). To enhance and refine the survey effort to better capture the important sources of variation and to achieve a more consistently acceptable coefficient of variation and representative density estimates, we recommend:

- Increase the number of concession transects, even if this requires reducing or eliminating repeated surveys of individual transects within a season;
- Standardize training and field methods across all organizations and concessions undertaking surveys efforts so data can be combined for analyses;
- Establish a Monitoring Working Group that can review the emerging survey efforts and recommendations regarding them, facilitate collaboration and communication amongst organizations undertaking surveys and ensure that methods and training requirements are consistently implemented;
- Increase efforts to put population information into the context of landscape connectivity and habitat conditions, as such an understanding of these dynamics would provide the kind of insights needed to make meaningful management decisions now and into the future.
- DWNP should designate the collection of concession-level data and oversee the pooled use of these data by an analyst qualified in to conduct the demographic analyses or modeling. (Heinemeyer et al., 2016, p. 29).

The Round River work is interesting because of its efforts to work collaboratively with academic, government, and community stakeholders to provide types of survey data that had been identified as useful by a cross-section of stakeholders. Asked in a 2019 interview whether there has been use of the data, a Round River programme manager responded that she believed the data themselves are considered to be of limited use, but the learning that takes place through interactions between community members and students is of great value **[RT011].**

Apart from the Kalahari Conservation Society and Birdlife Botswana, since the 1960s, research-based non-governmental organisations have been established on both non-profit and consultancy models, most of them including data collection in the form of wildlife survey work. As boundary organisations that link research with practical interventions through stakeholder interactions, and that host student

researchers, their potential role in research uptake in the country is important and is explored a little in the following chapters of this thesis. Some of these organisations are listed here:

Botswana Herbivore Research

Botswana Predator Conservation Trust (BPCT)

CARACAL

Cheetah Conservation Botswana

Chobe Lion Research

Chobe Wildlife Trust

Claws Conservancy (Pride in our Prides)

EcoExist

Elephants for Africa

Elephants without Borders

Kalahari Research and Conservation

Kanobo Conservation Link

Leopard Ecology and Conservation

Living with Elephants

Okavango Crocodile Research

Plants and People Africa

Raptors Botswana

Rhino Conservation Botswana

Tau Consultants

2.5.2 The role of the University of Botswana's Okavango Research Centre

The University of Botswana's founding of the Okavango Research Centre[5] in Maun in the mid-1990s through expansion of a small field station had, from its inception, the intention of producing research aligned to the needs of government managers at all levels:

> In view of the distance between Maun and Gaborone, the Centre is intended to provide a local source of support for government agencies … District Development Committees, District Land Use Planning Units and Land Boards in the Okavango region, as well as the local offices of Ministries and Departments responsible for natural resource management, such as the Ministry of Agriculture; the Ministry of Local Government, Lands and Housing; and the Department of Water Affairs. Through intensive and regular consultations, with these agencies in Maun, Lethakane and Gaborone, every effort will be made to ensure the relevance of the Centre with respect to development in the Okavango region …. The work of the ORC is thus planned to be closely co-ordinated with the activities of the relevant Government agencies. Consultation on this issue is currently under way, and is hoped to lead to active use of ORC facilities by Government research programmes in the region. … With the adjacent Wildlife Training Institute (under DWNP) ORC will maintain close working relations based on equity and mutual interests. (University of Botswana, 1995, pp. 12–13)

Research at the ORC was intended to include, "when appropriate", a good part of northern Botswana beyond the borders of the Okavango Delta.

The proposal for the Centre, prepared by the Kalahari Conservation Society for the University of Botswana in 1991, had recommended a research spectrum as wide as possible "… although core research is likely to be of a biological and ecological nature" (Shaw & Heiden, 1990, p. 2). The proposal also recommended formation of an external advisory committee that would guide research policy, dissemination of research findings, identification of appropriate research programmes, liaison with government on the issue of research permits, and evaluation of research projects (Shaw & Heiden, 1990, p. 22).The proposal referred to research gaps identified by the large studies carried out in the 1980s for the Botswana government by Swedeplan and the Snowy Mountains Engineering Corporation:

> ….hydrobiology, limnology, the taxonomy and distribution of invertebrates, amphibians, fish and certain mammals and bird species. Other gaps include hydrology, seismology, geomorphological processes, archaeology, linguistics and sociology. There is also little short and long term monitoring of the environment, and management of all aspects of the environment at an early stage. It would also appear that the coordination of research findings has been lacking….the vast literature on the Okavango … is relatively inaccessible to researchers, as are the databases maintained by Government departments such as DWA and DWNP. (Shaw & Heiden, 1990, p. 8)

[5] The Okavango Research Centre was named the Harry Oppenheimer Okavango Research Centre following a substantial donation by a foundation to support construction of buildings for the centre. In 2010, the University of Botswana renamed the centre the Okavango Research Institute.

The Project Memorandum of 1995 stated that the ORC was to give priority to "specific environmental management and development problems … designed in consultation with the area residents and government authorities responsible for the environmental management and socio-economic development in the Okavango region" (University of Botswana, 1995, p. 14). Of the six specific areas of research identified, however, five were focused on topics in environmental science, rather than social topics:

- Hydrology of the Okavango Delta
- Nutrient flux in the Okavango Delta
- Ecological function of the seasonal swamp
- Bio-diversity in the Okavango Delta
- Community conservation and development
- Ecological history of the Okavango Delta.

Long-term monitoring of "… key environmental and socio-economic parameters …" was linked to these research tasks:

> Priority will be given to research programmes that develop data bases on such parameters, and feed relevant information on processes and trends to the appropriate management and agencies in local and central government. (University of Botswana, 1995, p. 19)

As the Centre developed, studies focused on wildlife species were not considered a priority, mostly because of the large number of wildlife studies being carried out by external researchers.[6]

A funding proposal developed by the Kalahari Conservation Society in 1996 noted that the ORC was "… attracting an increasing number of research projects … In some cases, participants are not aware of each other. The ORC will aim to improve the quality and usefulness of the various research projects by acting as a base for coordination and communication" (Kalahari Conservation Society, 1996, p. 15).

In 2002, a study by the Education, Democracy and Development Initiative (EDDI) of the United States government looked at the research projects and agenda of what had become, with an injection of funding, the Harry Oppenheimer Okavango Research Centre (HOORC). The study found a strong culture of collaboration with international partners:

> The level of international collaboration was recognised as outstanding and important to maintain. However, the 'drop-in' nature of many of the international projects has diverted HOORC from maintaining a balanced research portfolio and has especially negatively impacted, lately, the social science and tourism research. Also, it was noted that almost all the research results were taken out of the country and not shared by HOORC or the international researchers with Botswana, either locally or nationally.

[6] Personal communication, Susan Ringrose, 2015

> Further, it was felt that much of the research has significant policy implications but that there are no avenues to get the information to policy makers. (Brown & Russo, 2002, pp. 3.1)

The EDDI study also cautioned the Centre about depending too much on research consultancies, describing them as 'a necessary evil':

> Often these come from Government wishing to understand better the environmental and social consequences of policies or actions. They cannot easily be rejected. At the same time they can divert energies of the Center and its staff away from stated missions and objectives as well as ongoing funded research projects. (M. T. Brown & Russo, 2002, p. 2.9)

The study did, however, provide a list of specific requests for research gained through its interviews with stakeholders, many of them government officials:

> Government departments that neither had staff or resources to undertake long-term studies or base-line studies made many of the requests for long-term research efforts. The specific request heard time and again, was 'more applied research that can be implemented at the community level'. (M. T. Brown & Russo, 2002, p. 3.2)

The EDDI study identified communications and information management issues that were affecting the Centre's research effectiveness. It pointed out a lack of exchange and collaboration among the research units, poor communications between the Main Campus and the Centre, and between the Centre and its community of stakeholders, who expressed "… their dismay that research results are not widely available." Centre researchers also expressed their concern that data was disappearing and was scattered in varying qualities and formats (M. T. Brown & Russo, 2002, pp. 3–4).

In 2008 the University of Botswana's Senate approved a new research strategy directly related to the Botswana's National Development Plan 9, and aimed at, among other goals, increasing international collaboration. The strategy's list of priority research areas included, "Environmental systems and natural resources management studies, environmental issues at the local, national, regional and global levels, emphasising the inter-relationship of human and ecological concerns in achieving sustainable development, including the management of natural resources and ecosystems" (University of Botswana, 2008, p. 7).

By 2008 the Centre had improved its research information management capacity through development of facilities for its GIS Laboratory, library collections, and herbarium. Public access to the research outputs of its researchers had also improved through incorporation of these in the library catalogue and listing on the Centre's web site. Much of this work was accomplished through support by donor funded projects, the most important of which was the Okavango Delta Management Plan (ODMP) project. The ODMP played a major role in addressing both research priorities, and the issues of research relevancy, information sharing, and collaboration in northern Botswana.

2.5.3 Independent researchers

Adams and McShane have written about how the 1960s began an 'invasion' of foreign scientists, many of them PhD students, in Kenya's Serengeti National Park. They argue that much of the work took place in a 'cultural vacuum', and that the resultant exhaustive documentation of species in the region did not lead to successful conservation of the animals that were studied (Adams & McShane, 1992, p. 86). In Botswana, the government, acknowledging the lack of internal research capacity, officially encouraged researchers from other countries to contribute to Botswana's knowledge base (Botswana Dept. of Wildlife and National Parks, 1993, 2014c).

The evaluation report of the Remote Area Development Programme (RADP), which had encouraged private academic research, pointed out that most of the large number of studies of the regions included in the RADP were done by non-resident scholars from the North. It was a problem, however, that these researchers had little direct involvement in the programme, or in its accompanying policy debates: "In any event, the heyday of expatriate research interest in the Basarwa, when the apocryphal herds of wandering anthropologists roamed the Kalahari in search of the last uninterviewed Bushman, appears to be over" (Chr. Michelsen Institute Development Studies and Human Rights, 1996, pp. 97, 136).

While this might have been true of anthropological research, the 1980s and 1990s saw increasing numbers of researchers coming to Botswana to study wildlife. Between 1967 and 2013, the number of peer reviewed publications about Botswana co-authored by researchers from other countries increased from 26 to 63 percent. Of these, at least 10 percent were focused on environmental topics (UNESCO, 2013, p. 26). Research permits issued by the DWNP during this period, mainly to independent researchers, numbered at least 250.

The DWNP formally recognised the potential contribution of foreign researchers by incorporating a policy for independent research in its wildlife research strategy from 1993 onwards (Botswana Dept. of Wildlife and National Parks, 1993, 2004, 2014c). Since production of its first national wildlife research strategic plan in 1993, Botswana's Department of Wildlife and National Parks (DWNP) included the "coordination of privately sponsored wildlife studies to ensure consistency with national objectives" (Botswana Dept. of Wildlife and National Parks, 1993). Updates to the plan in 2004 and 2016 reiterated the ongoing need for independent and private researchers to contribute to the country's knowledge base, supplementing the work of the Department's own researchers (Botswana Dept. of Wildlife and National Parks, 2004, 2016).

In contrast to the large population surveys carried out on behalf of the government, independent research has been carried out mainly as short-term studies by graduate students, or through

establishment of longer-term projects focused on species or ecosystem role, projects that often make use of graduate student work.

A government-wide system of research permits was originally introduced by Botswana's Office of the President to apply to researchers who wished to conduct research under the Anthropological Research Act of 1967 and the National Monuments and Relics Act of 1970 (as revised). The Office of the President also approved research guidelines that were drafted by an ad hoc Research Coordinating Committee that was convened by the then National Institute of Research at the University of Botswana. Administration of research permits has since been delegated to line ministries, where a coordinator distributes applications to appropriate departments and divisions to review and submit recommendations to approve or deny[7]. The parent ministry for the DWNP is the Ministry of Environment, Natural Resources, Conservation and Tourism (MENT). Permits normally stipulate that principal investigators regularly report their progress to a relevant department, with copies sent to appropriate regional representatives; usually those who are closest to the research location. The investigators are also required to share their final results with the Government of Botswana:

> 4.2.5.6 The Researcher/Filmer/Photographer shall submit seven copies of films, videos, and any publications based on environmental research conducted in the Republic of Botswana directly to MEWT for distribution to stakeholders. (Botswana Ministry of Wildlife Environment and Tourism Research and Development Division, 2010, p. 12)

The permit system was meant to apply to all research, including that conducted by Botswana institutions and large, externally-funded development aid projects, but has tended to focus on external independent or private researchers, many of these carrying out graduate studies. It became generally understood that the permits issued by MENT were needed mostly for the purpose of allowing access to, and off-road driving within, Botswana's protected areas, which cover approximately 40 percent of the country, and which host the charismatic animals that often interest researchers. A valid permit issued by MENT entitles the researcher to apply for not just access and off-road driving, but other privileges like immobilizing wildlife, collecting voucher specimens or samples, and access to MENT data sets. These activities are covered by supplementary permits issued by MENT's relevant departments, such as DWNP.

Until 2017, permits for both research and capture of footage for nature films were processed through the same system, leading to shortcomings in reviewing of filming applications, as government officials at various departments within the ministry were not well-versed in the norms and standards of the industry. It was also realized that opportunities for citizen empowerment,

[7] Flyman, Michael. Written comment, October 2018

employment creation, and revenue generation for the country were being lost by not exploiting the value chain in the filming sector. A review by the Ministry of the permit process in 2015-2017 finally separated the two activities, creating two different sets of guidelines and fee structures.

Among the issues raised by the Ministry during the review were that researchers and film-makers did not account for their movements, did not comply with statutory requirements to deposit research outputs and filming products; and progress reports were either not submitted at all, or arrived late. New guidelines, finalized in 2019, reiterated the role of a Research Review Committee for all permit applications. The committee would evaluate applications based on the following criteria, four of which speak to local relevance, knowledge exchange and benefits to Botswana, and one of these to interactions with stakeholders.

a) **Alignment with the Ministry research agenda**: All researchers are required to demonstrate that their proposals are consistent with the research agenda of the Botswana Government in general and MENT in particular. The Ministry research agenda is currently guided by, among others, the National Biodiversity Strategy and Action Plan, Wildlife Conservation Research Strategic Plan, 2016-2022 and National Action Plans for various Multilateral Environmental Agreements. The checklist provided on Appendix 1 must be used to ensure a robust link between the submitted proposal and MENT research priorities.
b) **Pathways to impact**: There must be clear demonstration of how intended end users will benefit from the research; what is to be done to ensure that research users have the opportunity to benefit from the research; methods of disseminating data, knowledge and skills in the most effective and appropriate manner; as well as how capacity building will take place.
c) **Qualifications of research personnel**: All the proposed research personnel must have relevant or appropriate qualifications and skills.
d) **Participation of citizens**: The composition of research personnel across all levels must show that the applicant has a commitment towards meaningful participation of Botswana citizens.
e) **Feasibility**: The applicant must be explicit in the Methodology section of the proposal in order to demonstrate feasibility of the project and ensure timely processing of the permit. The applicant(s) must also show proof that they have adequate resources to conduct good and proper research; or otherwise have access to facilities through collaboration with other researchers or institutions.
f) **Welfare and ethical considerations**: Any applicant whose proposed activities involve animal and/or human subjects shall submit proof of clearance by an Institutional Animal Care and Use Committee (IACUC) and/or Institutional Review Board (IRB).
g) **Access and Benefit Sharing**: Botswana is party to the Nagoya Protocol on Access and Benefit Sharing (ABS), which provides a transparent legal framework for the fair and equitable sharing of benefits arising out of the utilization of genetic resources (Botswana Ministry of Environment Natural Resources and Tourism, 2019).

A 24-item checklist appended to the Guidelines asks applicants to evaluate the relevance of their proposed work to Botswana conditions. The contribution of independent researchers to knowledge about wildlife in Botswana appears to be clear. The controversy surrounding their role was one of the motivations for the work on this thesis and is discussed in more detail in Chapter 5.

2.5.4 The private sector

As discussed earlier in the chapter, Botswana has long been a destination for foreign trophy hunters and, more recently, for tourists wanting to experience wilderness by watching wildlife. The industry supporting both hunting and photographic safaris has been an important stakeholder in wildlife research through sponsorship of researchers and engagement in research-related activities to fulfil business obligations to the Government of Botswana. As discussed further through examples in Chapter 6, the industry recognises its vested interest in wildlife, and the value of wildlife research in engaging with its customer base.

2.5.4.1 The hunting industry

The consumptive use of wildlife is so important in the history of Botswana's wildlife management that this section looks in more detail the commercial trophy hunting industry's involvement in research.

Safari hunting, between its general introduction as a viable economic activity in 1961 and 2014, when it was terminated as part of a general ban on hunting on public lands in Botswana, became a source of wildlife monitoring data through the imposition of government quotas, collection of trophy information, and field observations by the industry. As well, through the industry's bodies, the Botswana Wildlife Management Association (BWMA), representing hunters, and Botswana Wildlife Producers Association, representing game farmers, became a source of active research in an iterative process of regulation and response.

The increased awareness of declines in wildlife populations of the 1980s began a process of questioning of the wisdom of allowing hunting (Arntzen & Veenendaal, 1986, pp. 93–94). Elephant were excluded from 1989 when the African elephant was listed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This "... followed a decade of fierce debate as to how many elephants there were in Africa, and whether or not their numbers were declining to unsustainable levels" (C. Thompson, 2004, p. 70).

Following the clear indication of intention by Botswana to promote wilderness-based tourism as an industry through the Tourism Policy of 1990, and the Wildlife Conservation and National Parks Policy of 1992, Botswana's policy in the 1990s focused on what was referred to as sustainable use[8]. Discussion and debate about whether Botswana should include trophy hunting in its mix of economic activities waxed and waned during this period.

[8] The IUCN defines sustainable use as "uses through harvesting of animals and plants and non- consumptive uses to maintain cultural and aesthetic values given to biological diversity in different societies" (IUCN Sustainable Use Specialist Group, n.d.).

In 1991, a first draft of an elephant management policy, that included culling, addressed the increase in elephant numbers in northern Botswana. *The Conservation and Management of Elephants in Botswana*, was developed by the Botswana Department of Wildlife and National Parks in consultation with stakeholders, including the trophy hunting industry, with the objective of "… managing elephants on a sustainable multiple use basis in accordance with the 1986 Wildlife Conservation Policy and the 1990 Tourism Policy" (Botswana Dept. of Wildlife and National Parks, 1991). The policy's section about research called for studies of population movements and distribution, habitat impact, artificial water points and sustainable harvesting. Specifically, the effects of cropping, culling and hunting on population size and growth rate were to be monitored, as were the disturbance effects of harvesting on distribution and movement patterns (Botswana Dept. of Wildlife and National Parks, 1991, p. iii). Lobbying efforts of Botswana and its southern African neighbours to have their elephant removed from CITES control led to reintroduction of elephant hunting quotas in 1997. Lion hunting quotas were withdrawn in 2001 and reinstated in 2004.

Government and donor-supported Community-Based Natural Resources Management (CBNRM) programmes intended to reconnect the livelihoods of communities with their wildlife resources were designed to take advantage of high trophy hunting revenues through partnerships with private companies. The potential and promise of CBNRM led government to issue 15-year leases for hunting concessions in 1996: the success of these programmes depended on controlled consumptive wildlife use. In the background, in response to the growth of poaching in the 1970s and 1980s, the Botswana Defense Force developed considerable anti-poaching capacity under the direction of *Lieutenant* General Ian Khama (Henk, 2007).

Another example of the government's assimilation of research findings into its policy and practice is the gradual uptake of the concept of adaptive management over 30 years. This resulted in design of programmes to incorporate survey, monitoring and research results in the wildlife management process, as illustrated in Figure 2-3 about the use of monitoring data in quota setting for trophy hunting (Kalahari Conservation Society, 2009, p. 21).

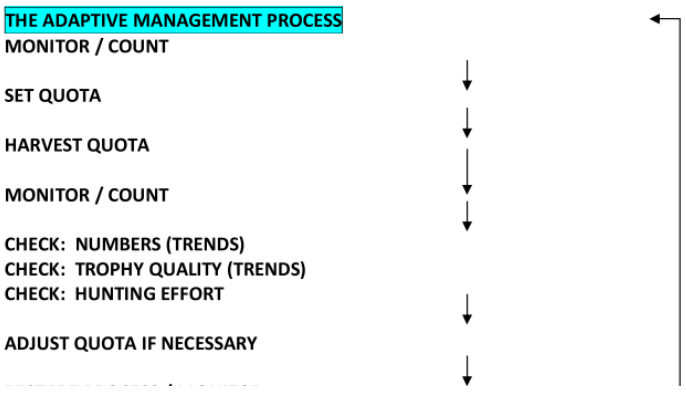

Figure 2-3 Adaptive management process diagram

Between 2000 and 2013 the hunting debate continued, as ineffective management of CBNRM hunting benefits by communities was criticised, and central government control of income from CBNRM imposed (Schuster, 2007).

Arntzen's 2003 review of CBNRM projects in Botswana pointed out several ways that research was either lacking, or not being used to provide adaptive management feedback from Community Based Organisations (CBOs) to the CBNRM process:

> … CBNRM projects do not collect environmental baseline and monitoring data. Therefore, it is virtually impossible to quantify the environmental impacts. Such data should be collected and used in resource planning and management in future. … Monitoring is restricted to the work of Community Escort Guides but the data are not processed and analysed…. wildlife-hunting quotas are determined by DWNP after consultation with CBOs. CBOs feel, however, that their comments are usually not taken into consideration and they have therefore stopped commenting. This situation is regrettable as the perceptions of DWNP and CBOs about the state of wildlife resources are very different. While DWNP often holds the view that resources are in decline, and hence reduces the quotas, CBOs consider the resources fairly stable or to be even increasing. They do not understand why quotas are decreasing. It is possible that CBOs and hunting companies may be biased in favour of higher quota and hence more revenues. At the same time, the process of quota determination is not transparent, as the link between resource changes and annual quotas is not documented. (Arntzen et al., 2003, p. 33)

Arntzen's study recommended that the Botswana government increase data generation and analysis by introducing standard baseline information and monitoring, with community participation, and with performance indicators, development of hunting quotas in co-operation among DWNP, CBOs and the private sector; monitoring of wildlife off-take within CBNRM areas against set quotas, compilation of annual CBNRM statistics, and a CBNRM Research Fund to stimulate applied research about CBNRM (Arntzen et al., 2003, pp. 31, 33). "It is important to review regularly the threshold levels of wildlife density below which wildlife activities become non-viable". (Arntzen, 2003, p. 27)

This experience with CBNRM was not unique to Botswana. Newmark and Hough (2000) found that lack of knowledge was one of three major contributing factors to the failure of integrated conservation and development projects (ICDPs) in Africa:

> … designers are often reluctant to incorporate a significant research component into these projects. Part of this reticence stems from the crisis nature of most conservation initiatives: Research is often viewed as a hindrance to action and an expensive luxury. Yet incorporating a significant research component into ICDPs is essential if the ecological and social dynamics encompassing each project are to be accurately defined and if conservation and development are to be truly integrated. (Newmark & Hough, 2000, p. 589)

Revisions were made to the Wildlife Conservation and National Parks Act (2002), Wildlife Conservation and Game Reserves Regulations (2001), Wildlife Management Area Regulations (2001) and Community Based Natural Resources Management Policy (2007). The National Biodiversity Strategy and Action Plan was promulgated in 2007. The 1992 Wildlife Research Policy was updated in 2004 and a set of new national biodiversity indicators was issued in 2012. Ian

Khama, an acknowledged conservationist, became President of Botswana in 2008, introducing a new level of support for photographic, as opposed to consumptive, wildlife tourism (S. I. Khama, 2010).

The types of data available and used in the formulation of wildlife management policy and in the policy debate about hunting in Botswana are shown in Table 2-2 below.

Table 2-2 Types of hunting data

Type of Data	Producer
Animal population surveys, recording numbers, characteristics, and movements	DWNP, Projects, Specialist researchers
Trophy records, reflecting age, size, and distribution	BWMA
Problem animal reports	DWNP
Income from hunting	BWMA
Proposed and issued quota data.	BWMA, DWNP

A second (2003) and third (2011) draft of the elephant management plan were produced but the document was not officially approved by government. The lion quota was officially withdrawn in 2008.

In July 2008 the Government of Botswana issued a notice that all concessions were to be converted from multi to single purpose use, that is, to non-consumptive photographic tourism. The hunting industry responded with a series of high level meetings with government officials to present evidence that this was poor policy. In August 2009, President Khama attended the annual Government of Botswana Tourism Pitso, speaking at length about his vision for non-consumptive wildlife tourism. In response to complaints from the hunting industry, he told the meeting that "hunters should consider themselves an endangered species" (BWMA, Personal communication).

The efforts of Botswana's commercial hunters to prove the value of their industry were set in international context by a joint publication of the Food and Agriculture Organisation of the United Nations (FAO) and the International Council for Game and Wildlife Conservation in 2010. This report, which recommended better economic analysis of consumptive use of wildlife in national accounts, concluded, "Given that hunting is a widespread component of rural activities it is vital that its importance to national and local economies is established" (Booth, 2010, p. 33).

The government's stated commitment to the need for research to support wildlife policy making is summarised in the revised Wildlife Policy of 2012, approved by Parliament in August 2013:

> Wildlife research and monitoring will be strengthened and given more emphasis in wildlife management. Research is a key component of sustainable utilisation and management of

> wildlife resources. The results of research and monitoring need to be incorporated into processes for wildlife management and shared with all stakeholders. Current research and resource monitoring activities such as aerial surveys (DWNP), ground counts, specific research projects (e.g. predator research) and private initiatives (e.g. bird inventories and monitoring) will be enhanced. (Government of Botswana, 2012, p. 18)

The new document announced a 25 km non-hunting buffer zone around national parks and reserves, and indicated a policy move towards photographic tourism, "which provides more long-term benefits for the local economy". The policy still encompasses a sustainable use approach, aiming to facilitate "a restricted and regulated wildlife-based industry that is premised on the principle of sustainable off-take, science-based quota setting, and efficient utilisation of the resource" (Government of Botswana, 2012, p. 8).

Leases on hunting concessions expired in 2011 but were extended twice. The trophy hunting industry remained hopeful that there would be a change in policy. Then, in September 2013, the government issued a notification of cessation of all forms of hunting, except for game birds, beginning in January 2014:

> The decision to temporarily ban hunting has been necessitated by available information which indicates that several species in the country are showing declines. The causes of the decline are likely due to a combination of factors such as anthropogenic impacts, including illegal offtake and habitat fragmentation or loss. (Botswana Ministry of Environment, 2013)

In general, scientific and scholarly research in Botswana over a 30-ear period revealed no significant biological harm on wildlife populations and rather suggested economic good from a regulated trophy hunting industry Research has tended to focus more on the ecological threat of land use change and destruction of habitat, and on the perceived failure of the government to effectively implement its conservation plans.

The wave of social science research that gathered strength in the 1980s agreed that Botswana's wildlife policies had further impoverished many rural people and it should be a priority to ensure real economic value from wild animals for citizens living near wildlife (Gibson & Marks, 1995).

Much of the more recent literature has argued from the point of view that the improvements to local livelihood sought by the trophy hunting industry should not be readily abandoned.

An economic study by Barnes in 2001 had reported that consumptive use of wildlife was profitable for the country, and that a ban on consumptive use would exacerbate the threat of livelihood-based cattle keeping on the third of land (Barnes, 2001). Joseph Mbaiwa also argued that:

> … to apply a global ban without taking into consideration these control measures by Botswana to promote sustainable wildlife use and improve rural livelihoods may defeat the entire spirit of sustainable development. ...community-based safari hunting has been able

> to improve rural livelihoods when considering socio-economic benefits such as the availability of game meat, creation of employment opportunities, income generation, access to land and wildlife resources as well as funeral benefits and recreation services. This suggests that an arbitrary ban on safari hunting is likely to hurt small and remote economies in the Okavango Delta. (Mbaiwa, 2004, p. 48)

A report by the Kalahari Conservation Society, commissioned by the Worldwide Fund for Wildlife (WWF) in 2009, recommended that,

> … rather than abandoning the proven benefits from sustainable use, we advise the Government of Botswana to adjust strategy and invest in research to identify factors currently limiting the value of hunting to conservation and rural development, and to identify steps to improve the industry. This study should also be sensitive to the needs of the local communities, the private sector, civil Society, neighbouring States and the international hunting fraternity. This would be consistent with the cultural and democratic values that Botswana is well known for. (Kalahari Conservation Society, 2009, p. 18)

These views would seem to be aligned to findings from elsewhere in Africa:

> Trophy hunting was banned in Kenya in 1977, in Tanzania during 1973–1978, and in Zambia from 2000 through 2003 (Leader-Williams & Hutton 2005; Lindsey 2005). Each of these bans resulted in an accelerated loss of wildlife due to the removal of incentives for conservation (Baker 1997; Lewis&Jackson 2005). Avoiding future bans is thus vital for conservation. (Lindsey, Frank, Alexander, Mathieson, & Romañach, 2007, p. 882)

Studies of the trophy hunting industry outside of Botswana have pointed out the need for, and lack of, good data from the industry (J. E. Baker, 1997; Baldus, Damm, & Wollscheid, 2008; Lindsey, Roulet, & Romanach, 2007; Nuzzo, Traill, & Park, 2013). In Botswana's hunting story, the BWMA can be seen to have attempted to remedy this problem by collecting and using research and data to inform and influence the policy process.

The BWMA, an association to represent and professionalise the safari hunting industry in Botswana, was established in 1993 with a name change from the former Botswana Hunters Association (itself formerly known as the Botswana White Hunters Association), a shift in approach that indicated the Association was focused on hunting as a means of sustainable management, rather than just consumption. The Association's constitution includes several statements of its intended role in providing trustworthy knowledge to environmental policy-makers and practitioners:

> 4.1.4 To assist the Department of Wildlife & National Parks, a governmental or other interested entity in the provision of information on wildlife populations and migrations, and in detection and prevention of offences against the Act
>
> 4.1.5 Providing and disseminating statistics and information on the activities of the Industry to Government, Local Councils, Land Boards and other interested parties as and when requested
>
> 4.1.18 To carry out, promote and/or sponsor education on the activities of the Industry and the value thereof

> 4.1.19 To act as a repository for information on all aspects of the wildlife industry and disseminate such information to interested and affected stakeholders."(Botswana Wildlife Management Association, 1993).

The Association made use of both internal and external scientific research findings and recommendations in its efforts to develop a convincing argument for retaining trophy hunting as part of the wildlife management mix. It participated in Botswana's wildlife community of practice through consultative workshops, meetings and direct lobbying activities, collecting its own data and commissioning research in anticipation of policy shifts. Between 1993 and 2013, major research efforts by the BWMA included:

- Trophy database with data from the BWMA membership
- Lion hunting study (commissioned)
- Predator tooth and jaw study
- Economic analysis of the hunting industry (2001)
- Economic analysis of the hunting industry (2008)
- Participation in international isotope survey (2010-)
- Support for the 2010 Elephants without Borders / DWNP aerial survey
- Elephant study for northern Botswana (2011).

The BWMA was an active stakeholder in the wildlife management process. In 1999, it responded to a DWNP's 1998 survey planning report with a series of recommendations to revise the proposed monitoring strategy, arguing that the DWNP's approach "…provides very little useful information … because of unacceptably high sampling errors and because of the probability of large and variable biases towards undercounting" (Environmental Impact (Pty) Ltd., 1999, p. 2).

The BWMA's main source of original data were the records of animal parts retained, processed and eventually shipped to hunters as a souvenir of their hunt and kill. These were mainly tusks, horns and skulls removed from the kill site and taken to a taxidermist. The taxidermy process in Maun was often carried out by the private firm, Mochaba, which also housed the administrative offices of the BWMA. The location conveniently allowed for capture of detailed data about the origin, size and quality of the trophy animal.

Much of this data was shared with the DWNP annually when the Association submitted its request and recommendations for hunting quotas. The Association also fed information back to its members:

> Other species affected by the gradual decrease in hunting quota are the sitatunga, sable and reedbuck: little data has been made available to the industry as to the rationale for their removal and indeed, little credible scientific data are on hand to substantiate the action. Regrettably, there is little evidence that these particular species will be re-introduced to the quota. (Peake, 2004, p. 12)

Data from the trophy database was also used to examine the viability of elephant populations through development of a population model that could be used to predict the outcome of future hunting. This study found:

> Despite dramatic changes in population age structure from 1996-2010, the proportions of different sized trophies remained 'rock-steady'. … The impact of trophy hunting on the elephant population is negligible in biological terms. Trophy hunting has no effect whatsoever on limiting population growth and is not a management tool to replace culling when an elephant population is judged to be overabundant. (Craig, Martin, & Peake, 2011)

> The data collected by the Association through its commissioned studies was used to provide evidence for the sustainability of offtake, in particular in the case of predators such as lion and leopard. (Winterbach, 2008, pp. 1–2)

> Seeing that this work did not succeed directly in altering the course of government policy, management team members of the BWMA expressed some regret that they had not spent more time and effort lobbying influential government people in Gaborone. (BWMA, personal communication, 2013)

In 2019, with a change in presidency, and following country-wide consultations with communities, the moratorium on trophy hunting of elephant on Botswana was lifted. The reasoning behind Botswana Government's decision, while meeting many objections from the international conservation community, was supported by regional wildlife researchers and environmental commentators (Espley, 2019; Fynn, Thakadu, & Mbaiwa, 2019; Gomera, 2019; Motlhabane, 2019; Verreynne, 2019), and by its country neighbours at the meeting of Kavango-Zambezi Trans-Frontier Conservation Area in April 2019, where it was resolved to adopt a " … scientific wildlife management system in national parks, a development which will enable the bloc to harvest or move wildlife without hindrance" ("KAZA/TFCA position on elephant population management," 2019; Ncube, 2019). In response to negative reaction in the international media, the government contracted a New York-based public relations firm to present arguments for the change in policy, many of these based on reports of deaths and damage in rural areas caused by elephant (T. Moore, 2019).

2.5.4.2 The photographic tourism industry

As photographic safari tourism grew in northern Botswana from the late 1980s, some operators began to put to commercial use the requirement in their lease agreements that they carry out monitoring activities (Buckley, 2008, p. 6). While submitting reports as required to the DWNP, they also started using these activities in their marketing work, especially as their use of Web technologies grew (Lindsey et al., 2014). Linyanti Explorations, CC Africa (now &Beyond) and Wilderness Safaris were leaders in using this strategy. On the other hand, because enforcement of this lease requirement was low, and there were no generally accepted methods for monitoring in the

tourism concessions, many operators did not go beyond collecting data about sightings, data that they used mainly for marketing purposes.

In 2009, the BiOkavango project, in its review of Wildlife Management Areas (WMA) regulations and community, wildlife and natural resources and tourism lease agreements, had issued a set of guidelines for monitoring work that included concession managers:

> The use of Management Oriented Monitoring Systems (MOMS) will be promoted and systems and procedures will be described in the Plan as to how data collection shall take place, how data and information shall be shared and analysed, and how this information shall contribute to Strategic Adaptive Management approaches used in managing the WMA, under the leadership of the DWNP. In principle though the lessee shall carry out the following monitoring in terms of ensuring that biodiversity is protected and managed in their areas:
>
> Through their Concession Management Plans identify all important fauna and flora in their areas – inventories;
>
> Based upon the Concession Management Plan and identified management needs use MOMS to develop relevant monitoring data collection cards and check-sheets, so that appropriate data on wildlife and related issues such as poaching, problem animal management, rare, endangered and threatened species management may be collected;
>
> Analyse the MOMS data and interpret the information to be able to use it to better understand their area and to understand what action needs to be taken in response to the information obtained i.e. increasing anti-poaching patrols, improving communications and relations with neighbouring communities etc;
>
> Using the data and interpreted information to improve dialogue with DWNP and to compliment their research and management activities;
>
> Provide annual reports to DWNP on the biodiversity and wildlife management of their area, and to use this to stimulate dialogue on how the area may be better managed. (Natural Resources and People, 2009, pp. 37–38)

Monitoring work in the photographic tourism concessions, however, continued as a low level. In 2012, following the workshop, *The Future of the Okavango's Wildlife: an Urgent Call to Define an Improved Adaptive Management and Research*, the USAID-sponsored Southern Africa Regional Environmental Programme (SAREP) mounted a renewed effort to incorporate systematic monitoring and reporting of wildlife and environmental conditions in the tourism concessions. A protocol was developed, guides from selected concessions trained in use of the methodology, and a web-based platform created to allow capture of monitoring data. (Bourquin & Brooks, 2014; USAID, 2015). Following closure of the SAREP programme and handover of the system to DWNP, use of the protocol and system stalled. DWNP headquarters wished to manage the system from Gaborone (DWNP, Personal communication 2016), and reported that the web platform was incomplete, and concession staff, for the most part, continued with their sightings reports as before. In 2019, a new USAID-sponsored project, *Resilient Waters*, revived the effort by contracting a

consultant to investigate reasons for the failure of implementation. A workshop held in Maun in September 2019 produced a report, *Botswana Wildlife Management System*, that pointed to several issues: an over-complicated protocol, manual capture of data, poor Internet connectivity, and limited functionality of the web platform. The experience of one concessionaire, one of those operators that had assigned specific responsibility for environmental work to a manager, appeared to indicate that changes in the working environment at concessions, such as focused managerial responsibility, and better access to telecoms and hand-held electronic devices, might make it possible to carry out this work.

2.5.5 International organisations and influences

> In Africa alone, the EU has committed more than 500 million EUR for biodiversity conservation over the past 30 years, with a portfolio of on-going projects worth approximately 160 million EUR. (European Commission, 2014)

The global growth of powerful international conservation organisations and what has been called ‘eco-colonialism’ has increasingly influenced wildlife research in Africa (Scholfield & Brockington, 2009). Botswana research has seen support from organisations such as the Frankfurt Zoological Society, Conservational International, the African Wildlife Foundation, Wildlife Conservation Society, SNV, IUCN, WWF, Paul Allen Foundation, the Howard B. Buffet Foundation, and many others. The earliest, and perhaps most consistent, international support for wildlife research, however, has come from organisations whose objectives were based on economic development, rather than biodiversity conservation.

Botswana is classified an upper middle-income country by the World Bank (World Bank, 2014), so it is not a major foreign aid recipient. Nevertheless, in the 2000s it has received support from international cooperating partners for at least 2,533 projects, 105 of which focused on general environmental protection (AidData, 2014). The international cooperating partners who supplied funding or support for the most projects categorized as general environmental protection were seven foreign aid donors and projects supporting environmental conservation.

Table 2-3 International aid to environmental conservation projects

Organisation	Number of Projects
UK Foreign and Commonwealth Office (FCO)	6
Swedish International Development Authority (SIDA)	7
France Ministry of Education, Higher Education and Research (MEN)	8
USAID	8

Organisation	Number of Projects
Japanese International Cooperation Agency (JICA)	9
Global Environment Facility (GEF) / United Nations Development Programme (UNDP)	9
United Nations Development Programme (UNDP)	23[9]

The United Nations Development Programme (UNDP) reported in 2009 that the Government of Botswana's own contribution to development funding for environment as compared with other sectors, was limited due to the significant volume of funds from the Global Environment Facility (United Nations Development Programme, 2009). This finding was echoed by Juana's review of development aid for environmental issues in Botswana (2014), which stated that the government's expenditure on the environment was "an insignificant percentage of the overall development budget" (Juana, 2014). Juana's review indicates that, among bilateral donors, only France contributed specifically to environmental research.

While its budgetary commitment to environmental programmes is relatively small, the Government of Botswana has set up two national funds to specifically support environmental programmes: the Conservation Trust Fund (CTF), established in the context of CITES decisions about trade in elephant products through Statutory Instrument No 12 of 1999, and the National Environmental Fund (NEF), established in the context of the Convention on Biological Diversity through Statutory Instrument No. 70 of 2010. Both funds were intended to support increased engagement of Botswana community based organisations and NGOs in conservation activities (Autlwetse & Kontle, 2012; Government of Botswana, n.d.; Letsholo, 2017; Maramwidze, 2016). Wildlife research has been supported in the form of CTF funding – identified to mitigate human-elephant conflict – for development of management plans, studies of population dynamics, spatial ecology of elephants and human-elephant interaction in the southern and western peripheries of the northern Botswana elephant range, and the 2010 aerial survey work of Elephants without Borders (Chase, 2011).

Large internationally funded programmes that have been influential in wildlife research in Botswana a include NORAD's Remote Area Development Programme (RADP), the European Community's Wildlife Conservation in Northern Botswana programme.

RADP) was established in 1974 with the aim of providing basic services to people living in extreme remote areas, including Botswana's northwest. Supported by NORAD, the project focused on

[9] Author's own compilation

livelihood support, including the use of wildlife as a natural resource. Research had been identified as a strong component of the programme:

> A number of surveys and studies of specific areas have also been commissioned by RADP, basically for use in the Districts for policy and planning purposes. These, in addition to the considerable amounts of academic research which has been carried out in contexts outside RADP, constitute a considerable body of knowledge on the situation in the remote areas. But it has actually been argued that too much information exists and that the absorptive capacity for this kind of work is steadily decreasing in the Districts as well as in the central ministries. (Chr. Michelsen Institute Development Studies and Human Rights, 1996, p. 97)

NORAD's evaluation report also decried the lack of maintenance of the "… voluminous amounts of data…." collected by the programme, and the lack of impact of the studies (Chr. Michelsen Institute Development Studies and Human Rights, 1996, pp. 95, 98).

Anthropologist Robert Hitchcock made recommendations for a study and monitoring plan for the RADP in a 1988 report that included the observation that that the many recommendations for promotion of wildlife use had not been taken up (Hitchcock, 1988).

The European Community's Wildlife Conservation in Northern Botswana project that ran from 1993 to the 2000s was intended to:

> … 'consolidate gains in wildlife management made by previous EDF investments and through this, further human resources in the Wildlife Management Areas'…. aimed at improving the conservation and management of the northern parks and reserves of Botswana and attaining more efficient management of resources outside of the parks and reserves, ensuring better returns for local people. … The purpose of the project is to strengthen the institutional base so as to achieve its aims. (MGM Environmental Solutions, 1997, p. 3)

Two of the eight EDF project components focused on research: support to the DWNP Research Division Monitoring Unit to develop wildlife population surveys and to monitor changes, and support for the DWNP Computer Unit's monitoring systems (MGM Environmental Solutions, 1997).

The project's mid-term review found that the quality of aerial surveys had improved through the project work but cast doubt on the sustainability of the surveys. It recommended that, "Given the technical difficulties and the high level of precision demanded in conducting aerial surveys, consideration should be given to contracting all or part of this service to the private sector" (MGM Environmental Solutions, 1997, p. 61).

Collingwood, speaking on behalf of the European Union at the 1997 national conference, *Strategies for the 21st Century*, pointed out the EU's two studies in the cattle and wildlife sectors, and his disappointment that their findings had not been yet considered by government:

> We had hoped that these two studies would stimulate open and informed discussion of an issue that is becoming more crucial for Botswana and its partners as each year goes by. We even agreed a provision with the government, written into the latest five year co-operation programme, that these two studies would be fully reviewed and that their implications, if accepted, would be incorporated into future policy. It is a matter of regret to the EU that it has not been found possible to follow this through and that these two competent studies are gathering dust on the shelf. (Botswana Dept. of Wildlife and National Parks & Kalahari Conservation Society, 1997, p. 83)

An evaluation of European funding to Botswana reported that:

> The Wildlife Conservation and Management Programme was implemented at the district level (Ngamiland, Ghanzi, Central, Kweneng) with a focus on protected areas and adjacent wildlife management areas, the WCMP complemented past EC support under EDF6 and 7. It aimed at building institutional, governance, planning & management capacities of the Department of Wildlife and National Parks down to the district level, with a view to promoting more efficient wildlife conservation and management. The approach was complemented with community-development measures that, however, never came to fruition. The programme encountered numerous and complexly interrelated problems and obstacles. The overall assessment in retrospect remains unfavourable – as reflected by the fact that slightly more than half of the funding allocated to the programme had actually been used by late 2007. (European Commission, 2009)

While the largest research funding support to Botswana from international sources has focused on management of wildlife as an economic development activity, international NGOs and research institutions have also been active in building capacity in research for the sake of conservation itself. Participants at a workshop sponsored by the Smithsonian Conservation Biology Institute in 2010 identified priorities for training to support wildlife conservation in Botswana. Biodiversity monitoring techniques emerged as the third most important training need, after solutions for human-wildlife conflict and range management (Smithsonian Institution Conservation Biology Institute & Cheetah Conservation Botswana, 2010).

In the 2000s, several programmes funded by international organisations have included wildlife research as a component in their work. The included the Okavango Delta Management Plan project sponsored by DANIDA, the BiOkavango Project co-funded by the Global Environment Facility (GEF) and the Government of Botswana, sponsored by Conservation International, Western Kalahari Conservation Corridor Project (WKCC), Southern Africa Regional Environmental Program (SAREP) funded by USAID, The Future Okavango funded by the German government, Kavango Zambezi Transfrontier Conservation Area (KAZA) projects with support from multiple international organisations, the BioChobe Project funded by GEF and UNDP, the Northern Botswana Human Wildlife Conflict Project supported by the World Bank, and The Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) projects for the most part funded by the German government.

Between the 1960s and 2014 Botswana became a party to ten multilateral environmental agreements, and five Southern African Development Community (SADC) region protocols. Three of these had direct implications for wildlife research. The country signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973) in 1977, and the United Nations Convention on Biological Diversity (CBD) (1992), in 1995. The DWNP became the focal point for CITES and the Department of Agriculture for the CBD, with the Department of Environmental Affairs responsible for coordination through an MEA committee. The SADC Protocol on Wildlife Conservation and Law Enforcement in the Southern African Development Community Region (1999) was ratified by Botswana in 2000.

Obligations under the CBD included identifying and monitoring important components of biodiversity, including environmental impact assessment, building capacity for research, building public awareness through exchange of information, implementing conservation measures, ensuring sustainable use, and reporting to the CBD Secretariat. The National Biodiversity Strategy and Action Plan, approved in 2004, and revised in 2007, included in its strategic objectives, better understanding of biodiversity through research, data collection and inventories (Botswana Ministry of Wildlife Environment and Tourism, 2007, p. viii).

From the beginning, Botswana's reports to the CBD have highlighted challenges related to wildlife research:

> The Department of Wildlife and National Parks does not have sufficient research personnel to reach the goals of its Research Policy. Researchers from other institutions within and outside Botswana are encouraged to conduct research … on various aspects of wildlife management, provided that their research is in line with the Strategic Research Policy. (Government of Botswana, 1998)
>
> The low level of biodiversity prioritization is a challenge in protecting habitats. The lack of information and data is also a problem. There is also an uncoordinated approach to research, which has led to duplication of efforts and gaps in knowledge. Inventory and monitoring is low and uncoordinated. (Government of Botswana, 2005)
>
> At present there are no formalised mechanisms for exchange of biodiversity information between the institutions. Ecological research is mostly conducted by academic institutions and interaction between researchers, users, managers and communities is limited therefore scientific findings are rarely used to inform management decisions, particularly in relation to biodiversity. Baseline biodiversity data are limited and not integrated into management procedures, which inhibits the ability to understand land use impacts and detect resource and biodiversity trends … Knowledge management system that ensures information flow between researchers, resource users and managers is long overdue. (Botswana Dept. of Environmental Affairs, 2009, pp. xii, 67)

The 2015 report also acknowledged low achievement in research and monitoring, citing the lack of new data:

> *Coping with Environmental Change and Threats to Biodiversity*…. This objective received considerable attention. This could be because threats are immediate and tangible, and are often more closely related to departmental mandates for different aspects of environmental management. A large part of addressing threats comes through understanding them; however, many government departments do not have sufficient research capacity. Furthermore, the ability to ensure that non- governmental institutions take on the research needs is challenged by the availability of funding, and proper channels of communication and reporting. (Botswana Dept. of Environmental Affairs, 2015, p. xvi)

CITES obliges the government to maintain records of trade in specimens of species, report annually on CITES trade; and report biennially on legislative, regulatory, and administrative measures taken to enforce the Convention. The DWNP's Research Division was designated the Scientific Authority while the Management and Utilisation Division was designated the Management Authority (Keatimilwe et al., 2007, p. 5). The DWNP's monitoring of endangered species through its aerial surveys, and maintenance of the Elephant Trade Information System were meant to contribute to the country's reports.

The SADC Protocol on Wildlife Conservation and Law Enforcement stated that a Wildlife Sector Technical Coordinating Unit would coordinate "… regional programmes for research and capacity building in the management of wildlife resources", and that the State parties should develop programmes and mechanisms to "promote research which contributes to and supports the conservation and sustainable use of wildlife" (Southern Africa Development Community, 1999, pp. 10, 13). Implementation of the Protocol has focused on facilitating establishment of transboundary conservation areas such as the KAZA TFCA, and, most recently, on law enforcement related to wildlife crime (Magakwe, 2013, p. 81). The SADC Regional Rhino Conservation Project has an ongoing research and monitoring component (du Toit, Emslie, Brooks, Daconto, & Mungwashu, 2006).

The Ministry of Environment, Wildlife and Tourism's 2007 implementation strategy for multi-lateral agreements pointed out challenges in the areas of research and information sharing, saying that there was a need to develop capacity for data management and environmental monitoring and reporting, "… particularly in the districts to improve reliability and accessibility of data and information and help to integrate environmental issues into the district planning process and also provide reliable information for reporting" (Keatimilwe et al., 2007, pp. 22–23). The strategy also called for development of communications strategy to improve the understanding of the impact of environmental interventions and identify stakeholder roles.

2.6 Failure of uptake?

Research literature from the 1960s to 2014 has shown that wildlife research is being supported in northern Botswana but that it is fragmentary, uncoordinated, and not always being put to use effectively. What explanations are relevant?

The promise of local investment to support wildlife conservation has generated its own large body of research about ambitious experiments in integrated conservation and development in Botswana and its neighbouring countries.

Newmark and Hough found that lack of knowledge was one of three major contributing factors to the failure of integrated conservation and development projects (ICDPs) in Africa:

> … designers are often reluctant to incorporate a significant research component into these projects. Part of this reticence stems from the crisis nature of most conservation initiatives: Research is often viewed as a hindrance to action and an expensive luxury. Yet incorporating a significant research component into ICDPs is essential if the ecological and social dynamics encompassing each project are to be accurately defined and if conservation and development are to be truly integrated. (Newmark & Hough, 2000, p. 589)

This is reflected in the studies of CBNRM in Botswana (Arntzen et al., 2003). The challenge of integrating expensive and time consuming research and monitoring in local level governance processes has proved to be an ongoing barrier to conservation work (Chemonics International, 2013).

Others have noted that, even when research has been commissioned and made available, other factors that can obstruct uptake and use come into play:

> The sorrow of this situation is that unlike essentially every other place in Africa the Government of Botswana is extremely generous in its fiscal support of wildlife conservation. However the bureaucracy is often so lethargic, constricting and confining that the money appropriated cannot be spent on the supplies and equipment needed. Without decentralization and/or privatization of services this situation will continue to hamper progress and productivity. (Crowe, 1995, p. 7)

Laurel Neme, in her study of incorporation of environmental issues in Botswana's government, found five main explanations for the Botswana government's lack of attention to environmental issues: sectoral organisation of the civil service that favoured the entrenched interests of mining and cattle ranching, the varying strengths of constituencies, the low status and lack of resources of environmental bodies in government, the individual power of civil servants, and technocratic approaches that limited the influence of outside participants (Neme, 1995).

> A common thread to the perceptions and decisions of bureaucrats in Botswana is a rational, technocratic approach to issues. … Botswana's technocratic bias, combined with a scarcity of expertise, enhances the influence of individual civil servants. This lack of trained

> personnel has meant that each civil servant is the only, or one of a very few, expert in his/her field. Hence there are very few, if any, others who are able to critique other civil servants' analyses and recommendations on a scientific basis. The result is that consultation among the bureaucracy ends up being a 'rubber stamp' to approve the original idea because few have the technical background and credentials to suggest credible modifications. (Neme, 1995)

Moleele and Ntsabane made similar observations about the reasons for lack of progress with conservation planning in Botswana:

> … the environmental issues within government ministries are mostly addressed as general policy statements rather than goal-directed environmental development options. It is also clear that through these organs, a planned approach towards integration of natural resource management and development can be achieved. (Moleele & Ntsabane, 2002, p. 42)

Nevertheless, the literature reviewed in this chapter has shown that wildlife research has played an active part in Botswana's economic development. Institutional growth, suggests one former high-level government official, has perhaps led to fewer lines of communication that serve to link researchers and stakeholders, and by extension, the utility and use of wildlife research:

> *"In the past there seemed to be more applied research and therefore a closer relationship to people on the ground. In the 80/90s most if not all research went through Alec Campbell and then later KCS, who, with Alec's help and support, kept a good record of who and what and where research was happening. Also assisted and supported permits for outside researchers. They then made sure that research was left in country and was availed to the concerned people, as far as possible. Once UB [University of Botswana] and others started to do more and more research and more collaboration with outside institutions, which was very good, there was no single point of entry and therefore to a large extent control was lost. Also, there was a groundswell in the later 90s and 2000s with more and more researchers coming in to undertake research in the same area. This, if interreacting with communities, caused confusion, and lack of involvement."* **[G029]**

2.7 Conclusion

A review of literature that describes research in the context of wildlife management in northern Botswana shows that the principal steward of wildlife, the Government of Botswana, has from its beginnings in the 1960s been engaged in a continuous and iterative process with research issues and researchers. Through research findings, many of them commissioned by the government itself, it has been aware of the issue and of the suggested causes of wildlife decline, and of the recommendations of scientists to address the problem. It has incorporated this awareness in legislation and published policy instruments, and has adjusted these, over time, to meet changing circumstances. The environment for wildlife, however, has continued to erode. Failure to implement policies and enforce legislation is often considered to be the result of shortcomings at both the political and operational levels. The literature is filled with repeated recommendations and calls for action, which appear to be rarely fulfilled.

At the political level, for example, vested interests of the commercial cattle industry have been cited as the cause of continued rejection of research that demonstrates the negative effect of veterinary fences on wildlife migration. Suspension of the trophy hunting industry, in the face of evidence of no significant environmental harm and significant economic benefit, was linked to political action at the highest level of government. Studies, for example, that show elephant play a key role in the ecology of the country's northern riverfront have to be repeated in the face of ongoing unresolved human-wildlife conflict.

While public sector acknowledgement of the need for research that informs wildlife management has continued, interactions between researchers and the managers of the country's wildlife have, over the years, appear to have been reduced. This has occurred as the presence of foreign researchers with external funding and short fieldwork periods has increased and, with the growth of the country's bureaucracy and strengthened tertiary institutions, previous close links between government processes and scientific research have weakened.

It can be argued that these reduced interactions have resulted at the operational level, in lack of data, loss of data, poor data management, lack of relevancy, policy that conflicts with conservation objectives, low status of conservation agencies, poor ability to communicate with policy-makers, and lack of capacity to implement recommended interventions, all cited as causes for lack of success in making use of research findings to halt wildlife decline.

Wildlife research in northern Botswana, as in much of the rest of the world, has been actively sought and supported in the context of a utilitarian model. The important question of who the users and beneficiaries of the resource should be has been much discussed. Recognition of local communities as important holders of knowledge and as economic stakeholders has increased. The literature reviewed shows how Botswana's wildlife research has gradually incorporated more social factors, paying attention to the issue of livelihoods of the people who live near wild animals, and to the need for more engagement with these communities.

Graeme Gibson has summed it up:

> In the rush to utilize hard-won and important biophysical data, we risk oversimplifying the nature of human systems, especially political institutions that affect the production, protection, and distribution of natural resources …. Creating wildlife policy that can work, consequently, means more than establishing the trends and performance of biological systems and passing laws to protect them. (Gibson, 1999, p. 164)

The global trend towards incorporating these human systems in wildlife research, supported in Botswana through the country's experiments with CBNRM and in addressing human-wildlife conflict, broadens the community of stakeholders considered of importance to wildlife conservation

and management, and, by extension, the range of interactions that can potentially affect the uptake of research findings.

> …using scientific research to solve the problems facing wildlife management is beginning to move conservation away from the simplistic assumptions about Africa. For too long, scientists came to Africa collected their data, and went home, leaving our misconceptions undisturbed. After nearly a century of conservation in Africa, scientists and wildlife managers are just beginning to explore their common ground. (Gibson, 1999, p. 84)

The following Chapter 3 suggests that this common ground can perhaps be viewed as space for productive interactions that lead to effective use of the knowledge produced by research.

Figure 2-4 on the following page provides a chronology for key events discussed in this Chapter 2. It can be viewed using the Word or Adobe Acrobat reader zoom features.

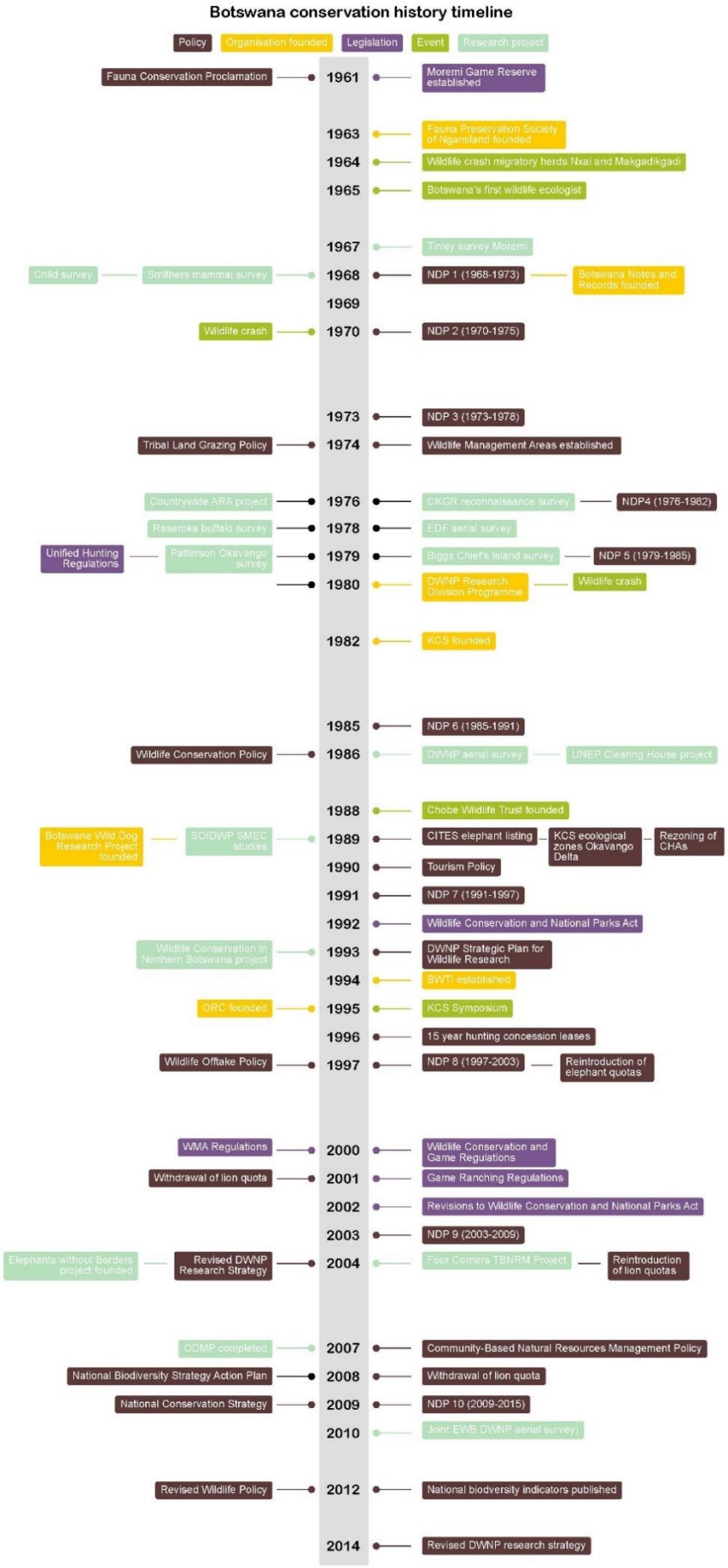

Figure 2-4 Botswana conservation history timeline 1961-2014

Chapter 3 Research-stakeholder interactions and uptake in conservation science

> "Successful conservation depends as much on people working together as it does on sound science and good governance" (G. S. Cumming, 2017, p. 1)

3.1 Introduction

This chapter reviews the literature of research uptake through considering productive interactions as an approach that builds on the learning from other conceptual frameworks that have been applied in conservation science research uptake studies. The literature included here is mainly from the overall field of biology, with a focus on work from ecology and conservation science. I have drawn, where appropriate, from complementary work from the social sciences and humanities --in particular, information management, philosophy of science, and politics.

In my search for literature relevant to the uptake of wildlife research in Botswana, I was guided by the question of how communications among researchers and the people who manage wildlife can better support the usefulness, and use, of scientific observations and findings.

Following this introductory section, the chapter has been developed in three parts. Section 3.2 elaborates productive interactions as a conceptual lens for the study. Section 3.3 looks at how the problem of research uptake as studied by conservation science scholars points to the value of the productive interactions approach. Section 3.4 examines the types of interactions that could meet the criteria for productive engagement that leads to further consideration of the research, and, perhaps to its use.

3.2 Productive interactions as a conceptual lens for studying research uptake

In studies of research uptake and evaluation, the productive interactions approach is transformational in that it shifts the focus of studies from end results to processes, and from attribution to contribution. This section relates how the productive interactions approach has been used for research evaluation, describes the nature and types of productive interactions, and discusses the importance of power relations.

3.2.1 Productive interactions as a focus in research evaluation

Increasing demand by governments and funders of research to demonstrate the value of their research investments has generated substantial evaluation[10] literature in the form of studies,

[10] The systematic assessment of a situation at a given point in time, past, present or future, usually directed at understanding if planned objectives have been realised (Kilvington, 2010)

guidelines, and discussions, much of this generated by an increasing body of programme evaluation work (Boaz, Fitzpatrick, & Shaw, 2009; Green, 2017; Greenhalgh, Raftery, Hanney, & Glover, 2016; Haddaway, 2014; Molas-Gallart, Tang, & Rafols, 2014; Penfield, Baker, Scoble, & Wykes, 2014; Walter, Nutley, & Davies, 2003). Environmental and conservation science work focused on the study and preservation of biodiversity is generating its share of these (S. Bell, Shaw, & Boaz, 2011; Alison Campbell, 2007; Green, 2017; Gustafsson, Díaz-Reviriego, & Turnhout, 2020; Jenkins, Maxwell, & Fisher, 2012; Jolibert & Wesselink, 2012; Leith, O'Toole, Haward, & Coffey, 2017; Nesshöver et al., 2016; Posner, 2015; Rau, Goggins, & Fahy, 2018; Tinch et al., 2016; Tschirhart et al., 2016; Van Wyk, Roux, Drackner, & McCool, 2008; Wolf et al., 2013).

Much of this literature suggests tools and indicators for use in evaluating the impact of research, but also points out the difficulty of attributing specific research findings to impacts on society over time. Kilvington (2010) argued for the application of social learning theory in developmental and participatory evaluation, recognising that:

> … to build capacity for social learning requires having some influence on the institutional arrangements and social conditions of a given problem situation, particularly those which facilitate or constrain participation by diverse constituents, and which provide opportunities for experimentation and learning. (Kilvington, 2010, p. 70)

She recommended embedding evaluation processes in the substantive work of environmental research and management. This approach is reflected in other calls for emphasising contributions that are made throughout a progressive process of gradual engagement, uptake and use (Morton, 2015; Ton, Vellema, & Ge, 2014).

Available evidence for measuring research's influence on science and other researchers has traditionally been:

- Outputs: journal articles, dissertations, books, conference papers, blog and discussion posts
- Citations: use of published research by other scholars
- Outcomes**:** changes in scholarly approaches and paradigms.

These have largely formed the basis of academia's criteria for judging a scholar's professional success.

Available evidence for measuring research's influence on society at large has been:

- Outputs**:** consulting reports, submissions to government investigations, regulatory reporting, popular media and blog posts, educational materials, policy and planning documents, public presentations
- Outcomes: changes in policy, legislation, awareness, behaviour.

In both cases, while *outputs* are relatively easy to identify, *outcomes* are difficult to track because of lengthy and complicated pathways to impact.

It is widely acknowledged that research uptake is not one measurable result: it occurs through stages – from the first exposure of new knowledge to a stakeholder through to incorporation of the knowledge in public policy in the form of legislation or planning mechanisms, possibly with demonstrable impact in the form of a problem solved or mitigated. Scholarly frameworks to describe these stages are similar, tracing this often-hierarchical, but rarely linear, process (Boshoff et al., 2018; Landry, Amara, & Lamari, 2001; Morton, 2015). In the uptake process, most scholars distinguish among transmission, conceptual or cognitive absorption of knowledge, actual use, and impact. Application of these frameworks opens the door to thinking in detail about what interactions take place at each of the stages.

3.2.2 Types and nature of productive interactions

The work of a European Union project, *Social Impact Assessment Methods through Productive Interactions* (SIAMPI) (2009-2011), suggested that examining the interactions between researchers and other actors would shed more light on probability of impact of the research on society. The project focused its work on what it called *productive interactions*: "… exchanges between researchers and stakeholders in which knowledge is produced and valued that is both scientifically robust and socially relevant" (Spaapen et al., 2011, p. 212). The emphasis is on processes that induce impact, rather than the impact itself. The SIAMPI approach's definition of stakeholder is someone who takes part in the iterative process that moves the results of research through uptake and use into social impact.

SIAMPI categorised the contacts among researchers and stakeholders that lead to further engagement and uptake of new knowledge into the following groups:

- Direct: interactions involving direct personal connections revolving around face-to-face encounters, or through phone, email or videoconferencing. These can be established through formal institutional channels but they can also be informal. In a local example, a researcher engages personally with a Botswana Forestry and Range Resources Department official to get vegetation monitoring data.
- Indirect: contacts that are established through some kind of intermediate "carrier". The intermediary can be inanimate media, or social networks or chains of different organisations. An example might be a consultant using Botswana Department of Wildlife and National Parks (DWNP) aerial survey data in a land use plan.
- Financial interactions: occur when stakeholders engage in an economic exchange with researchers. A research contract, a financial contribution, or a contribution "in kind" to a research programme, are traditional forms of financial interaction. For example, a Botswana safari company might fund herbarium research.

Studies of productive interactions by SIAMPI and in other research project settings have found (Akker & Spaapen, 2017; Dorp, Lowik, & De Weerd-nederhof, 2017; Molas-Gallart & Tang, 2011; Spaapen & Van Drooge, 2011):

- A variety of channels of interaction
- Adaptation to stakeholder needs
- New, unplanned interactions evolving
- Overlapping stakeholder boundaries
- Broadening of the social reach of the research.

Spaapen also pointed out that most productive interactions are the result of multiple interactions, and shifting of these from informal to more formal interactions:

> Our results show that unexpected, informal interactions only have impact, i.e. affect the behaviour of stakeholders, once they are followed up by further interactions. When they prolong they become more direct, and get embedded in networks of research and innovation actors (Spaapen et al., 2011, p. 15).

Thus, while many researcher-stakeholder interactions take place in informal settings or through serendipity, it appears that informal interactions contribute most when they lead to more formal interactions. A chance meeting in the context of a public lecture at Maun Lodge might lead to a working partnership to monitor insect behaviour on the boundary between a tourism concession and communal grazing land.

This approach tracks a collaborative, rather than competitive process. Ideally, various relevant stakeholders work together in research projects, combining different kinds of knowledge and expertise, designing a joint research and innovation agenda, being open and inclusive to allow for adaptive management. Engagement with stakeholders in the whole process of research, measured though productive interactions, should lead to the improved awareness, relevance, trust, and understanding that facilitate the uptake of research that may lead to societal impact.

Spaapen et al. (2011) define productive interactions as those which lead to efforts by stakeholders to apply research results to social goals, such as inducing behavioural change (Spaapen et al., 2011):

> … exchanges between researchers and stakeholders in which knowledge is produced and valued that is both scientifically robust and socially relevant. These exchanges are mediated through various ‘tracks’, for instance, a research publication, an exhibition, a design, people or financial support. The interaction is productive when it leads to efforts by stakeholders to somehow use or apply research results or practical information or experiences. Social impacts of knowledge are behavioural changes that happen because of this knowledge. (Spaapen & Van Drooge, 2011, p. 212)

Overall, the literature of research uptake and utilisation emphasises the importance of relationships among scientists and potential users of research. Actually working together to create shared understanding and to jointly solve specific problems – co-production – appears to be the most effective approach to support application of scientific knowledge to management of the natural environment. Cross-disciplinary and cross-sectoral consultation and collaboration in setting research priorities, agreeing on the use of language and standards to facilitate sharing and re-use of

data, and creating spaces, tools, and opportunities for social learning, are all recommended to support exchange that can lead to implementation of new knowledge.

Some research has indicated that interactions between researchers and stakeholders who are not considered closely related to the topic of research extend the reach of the research, leading to other types of impact than originally intended (Dorp et al., 2017).

The exchange may not be immediate, as is the case in many formal learning environments such as lectures and conferences, but if a researcher's approach or findings are acted upon by others through being used as a trigger for further investigation or action, the interaction may be considered productive.

3.2.3 Effect of power relations on productive interactions

> There is a need to acknowledge the power relations between various actors, their potential to be active participants, and the role they play in relation to researchers (Guimarães et al., 2015, p. 1830).
>
> Information can serve as a means of control, which generally reflects and consolidates the power of those who possess it. It can be used to shape political agendas, justifying legitimate authority and as a scapegoat and cover-up for (policy) change (Baycheva-Merger, 2019, p. 14).

Fazey et al. (2012) observed that knowledge exchange is "… a process of empowerment or disempowerment, where sharing and exchanging knowledge is inseparable from the dynamics of power" (Fazey et al., 2012, p. 28). McGreavy et al. (2013) also pointed out the need to consider power imbalances in boundary work:

> Our discussion of collaborations and partnerships brings issues of power to light in the most direct way; others have also noted the crucial importance of power within inter- and transdisciplinary collaborations …. Attention to power in relationships requires us to ask: How do our language practices and the spaces of interaction influence who expresses voice? Whose voices remain silent? How we can change the context in ways that make our common struggle for power more equitable? (McGreavy, Hutchins, Smith, Lindenfeld, & Silka, 2013, p. 4215)

This imbalance of power (as knowledge) in the field of wildlife management, where scientists, local communities, governments and advocacy organisations mix, is explored through the growing field of political ecology (H. M. Brown, Kamath, & Rubega, 2017; S. Jones, 2006; Kgomotso, 2013; Lute & Gore, 2014; Turnhout, 2018).

Drawing from the experience of agricultural extension, Garforth (1997) wrote:

> For constructive interaction to occur all participants in a workshop or conference situation need to be treated as equals …. Rivalries or the presence of a power-laden 'authority' are likely to prohibit effective communication: researchers may feel pressured to defer to an acknowledged expert. (Garforth & Usher, 1997, p. 317)

Interactions, then, among the stakeholders of research might be considered most productive when they result in a levelling of the knowledge 'playing field', resulting, in other words, in an exchange of knowledge that adds value to the interests of all engaged stakeholders. The added value may be immediate, potential, applied, realised, transformative, strategic or enabling (Wenger-Trayner, Wenger-Trayner, Cameron, Eryigit-Madzwamuse, & Hart, 2017). Such interactions, referred to by Wheelwright et al. (1996) in the context of Botswana wildlife research, and Smit et al. (2016) in the context of South African national parks, as a type of intellectual cross-pollination, are the essence of joint knowledge production, whether or not they are intended (Smit, Roux, Swemmer, Boshoff, & Novellie, 2016; Wheelwright et al., 1996).

'Levelling the playing field' refers to balancing the power imbalances identified by Fazey (Fazey et al., 2012) and McGreavy et al. (McGreavy et al., 2013) among stakeholders of research to reduce barriers to knowledge exchange. Each stakeholder comes to a research issue with its own agenda, assumptions, experience, and expectations that provide a unique lens for viewing the issue (Crona & Bodin, 2006). This lens can be either a barrier to, or facilitator of, the uptake of new knowledge. Understanding the composition of such lenses, and communicating through them, should increase the knowledge power base of stakeholders.

For example, funders of research, such as universities, government agencies, bilateral and multilateral agencies, non-governmental organisations, foundations, associations, and private sector interests would appear to have more power, and the broadest engagement, in a research process, as they often participate in the formulation, creation and use of research. On the other hand, the intellectual power implicit in established academic institutions can supress valuable alternative knowledge that could strengthen research findings. Turnhout et al. (2019), while recognising the challenges to redressing this imbalance, argued that its open acknowledgement, is vital to the success of co-produced research (Turnhout, Metze, Wyborn, Klenk, & Louder, 2020). The degree of 'productivity' of interactions may, then, depend on the degree and quality of shared power.

The specialised and reductionist nature of scientific enquiry can in itself create an uneven playing field, making it difficult for non-specialists – or in the case of transdisciplinary studies, specialists in other fields – to engage with research processes, and understand results. This means that productive interactions may also depend on effective knowledge translation: application of both dedicated time, and tools and methods that interpret different ways of thinking and enable clear communication of the essence of the work (Boaz, Hanney, Borst, O'Shea, & Kok, 2018; Boyd & Kramer, 2017; C. A. Campbell et al., 2015; Couix & Hazard, 2013; Laing & Wallis, 2016; Noblet, Lindenfeld, & Anderson, 2013).

3.3 The nature of conservation science and its associated knowledge exchange

Before further discussing how productive interactions fit into the approaches that conservation science scholars have taken in studying the issue of research uptake, it may be helpful to provide some background about the nature of conservation science itself, and its assumptions that might affect the field's treatment of the exchange of knowledge.

3.3.1 Conservation science: a crisis discipline linked to human activity

> Given widespread environmental concern and abundant information regarding human-induced ecocultural degradation, why does the overall pattern of unsustainability continue to grow? (Wals, 2009, p. 46)

Conservation biology grew out of ecology, as a discipline founded on intended action, based on awareness of threats to the viability of wild plants and animals in a rapidly changing world. From the beginning it was termed a crisis discipline, with a potential advocacy role built in (Meine, Soule, & Noss, 2006; Pullin, 2002, p. 145). The gradual shift in its name, from conservation biology to conservation science, has been the result of increasing recognition of conservation as an activity based on human activity, of the need to incorporate social sciences in the mix of approaches, and to move from interdisciplinary to transdisciplinary work (Chazdon, Brancalion, Lamb, Laestadius, & Calmon, 2015; Jules et al., 2002; Meine & Meffe, 1996; D. P. Robertson & Hull, 2008a). Since the 1980s, the concept of sustainable development – managing the use of natural resources to ensure the continuation of ecosystems vital to human well-being – has been closely linked and has generated its own literature (Clark, van Kerkhoff, Lebel, & Gallopin, 2016).

On one hand, there is growing recognition that conservation work must be based on understanding human social needs and behaviour, and must include all stakeholders in its planning, implementation, and evaluation (Fulbright & Hewitt, 2008, p. 341). On the other hand, the tools to support conservation are becoming more complex, requiring mathematical and technological expertise that is rarely found among the managers and stewards of the landscapes and species that are the targets of conservation efforts. This may lead to expecting a large 'leap of faith' by the potential users of scientific research: if they cannot fully grasp the nature of observed problems and proposed solutions, they must have strong trust in the work and intentions of scientists (Biggs et al., 2011; Hewitt & Macleod, 2017; Hojem, 2012; Prendergast, Quinn, & Lawton, 1999).

3.3.1.1 Biodiversity loss as a wicked problem

Conservation science is complicated, not only because of its dependence on understanding human motivation and actions. The concept of biodiversity – the importance of variety in maintenance of viable natural systems – is central to most conservation science work. Many studies emphasise that

in environmental , biodiversity is a special case, because making decisions about conservation of biodiversity involves dealing with a high degree of uncertainty, with significant gaps in knowledge about species, their habitats, and potential threats and their causes (Besek & York, 2018). Also, in many cases, postponement of decisions about conservation issues can lead to further risk. Cooney and Dickson (2005) argued that this uncertainty, combined with the complex nature of ecological interactions and interdependencies, weakens arguments for use of the precautionary principle[11] , a fundamental tool developed to deal with uncertainty in environmental. They called for more careful attention to allocating responsibility for provision of information and evidence, especially when the burden of proof falls on the poor or marginalised (Cooney & Dickson, 2005, pp. 302–303).

Most of the literature about research uptake in the context of conservation science makes reference to the 'wicked' nature of the problem of biodiversity loss, linked, as it is, to human activity, and calls for more direct interaction between science and society to tackle the issue ((Barmuta, Linke, & Turak, 2011; Batie, 2008; Bonnell, 2012; Game, Kareiva, & Possingham, 2013; Laurance et al., 2012; Nesshöver et al., 2013; Rittel & Webber, 1984; Stahl, 2014).

3.3.1.2 Scientific paradigms and the perception of loss and decline

Scholars from the political ecology school, in what has been called a postmodern approach, argue that conservation science often rests on dominant ideologies, assumptions and goals that are, at least, inappropriate and, in many cases, abusive (Adams & McShane, 1992; Kgomotso, 2011; Leach & Mearns, 1996; Mccann, 1999). Carruthers has pointed out that these scholars view the concepts of degradation and decline as outmoded in the face of a changed understanding of ecological systems as dynamic, rather than in a state of equilibrium (Carruthers, 2004, p. 382). Leach et al. explain this as policy-makers adhering to 'development narratives' that idealise earlier times and predict environmental disaster as a result of disruption of this former harmony:

> … policies founded on environmental orthodoxies have proved not merely harmful to African farmers and herders, but ineffective in ecological terms as well. Given the power relations through which … orthodoxies are produced and sustained, there is clearly no simple remedy for this state of affairs. Nor is it likely that 'more and better research' could improve the outcomes of policy for Africa's farmers and herders without more fundamental changes in the relationship between research and development policy-making. (Leach & Mearns, 1996, p. 28)

Leach and Mearns posited that, in Africa, the very structure of colonial government departments of agriculture and wildlife prevented the uptake of new ideas.

[11] A principle or approach that " … provides for action to avoid serious or irreversible environmental harm in advance of scientific certainty of such harm….", making initiators of development activities responsible for proving that no harm will come from the proposed activity (Cooney, 2004, p. ix).

> Even changing and contested views of environmental change in Africa may have posed little real threat to the continuity of policy and practice … if the scientific analysis to provide empirical support to early contentions … had not yet been carried out, the agenda for such analysis was already set through the establishment of these institutions. And, in turn, the persistence of these institutional structures provided a context in which their analysis could remain dominant, and be further elaborated. (Leach & Mearns, 1996, pp. 18–19)

Narratives of environmental degradation are durable and persistent because they tell a plausible story about the past and the present and offer an implied solution (Mccann, 1999, p. 177). Nevertheless, decline of wild populations remains a priority for conservation practitioners (Braunisch, Home, Pellet, & Arlettaz, 2012).

Scientific paradigms are persistent, and many earlier ideas and approaches have continued among northern Botswana's stakeholders in wildlife conservation and management. One of these is the concept of carrying capacity [12], part of what Leach et al. (1996) explained as the 'equilibrium' approach that considers ecological change a 'departure from the ideal'. Pullin (2000) explained this approach as the view that, left to themselves without further disturbance, ecosystems would return to their original state. This approach, Pullin said, has shifted to understanding ecosystems as naturally constantly changing, so that protected species and nature reserves will not stay the same without further interventions. The conservation management response to this understanding is to encourage diversity among patches of habitat (Pullin, 2002, p. 146).

Writing about how the Convention on International Trade of Endangered Species (CITES) affected views of African elephant management, Thompson said that this example,

> … allows us to see that change is possible, but yet that it takes action on a wide range of fronts that must somehow be coordinated enough to change the dominant paradigms of conservation. It also allows one to see that change does not mean that the legacies of older representations, identities, discourses and institutions disappear, but rather that they realign and reemerge (C. Thompson, 2004, p. 83).

A group of scholars have argued against the postmodern approach that says conservation research and management are based on mistaken views about the ability of local people to manage wildlife and other natural resources effectively, pointing to the growth and spread of human activities as the most important cause of biodiversity loss (Attwell & Cotterill, 2000; Caro, 2015; Spinage, 1998). Hutton et al. described the influence of this argument on conservation policies. They described how, in the late 1990s, international donors began to draw away from what they considered failures in community based management approaches, to rather support programmes that refocused on protected areas. The change in focus supported transboundary conservation area projects that

[12] The maximum number of individuals that can be supported by a particular ecosystem (or area) on a sustainable basis without degrading it (Park, 2007).

actually look to expand the land area protected (Hutton, Adams, & Murombedzi, 2005). And, yet, Reid (1994) pointed out that there was little scientific justification for preservation of what are perceived to be natural areas:

> Abandoned by ecologists who can no longer provide firm scientific support for strict preservation, 'deep ecologists' have reclaimed the moral high ground and rightfully reasserted the spiritual value of wilderness and value of wilderness for its own sake. There is indeed value in leaving portions of the earth surface untouched by deliberate human management. This value can be defended by science – providing a base line against which the effects of human intervention can be measured. … there is no point in continuing to pursue a 'correct' state of ecological systems as an objective of management when it is clear that ecosystems are both dynamic and subject to random changes. There is every reason, however, to seek to manage ecological systems – including areas left untouched by humanity – to ensure that humanity will be capable of responding to change. (Reid, 1994, p. 1)

3.3.2 The work of conservation science

Richard Bell, an ecologist working in northern Botswana in the 1990s, made the point that all wildlife conservation decisions are value-laden: " … the choice of management option does not follow directly from a knowledge of the ecological situation" (R. H. V Bell, 1982, p. 152). From the 1990s onward, recognition of the intersection of the scientific observations of biologists and the needs of human society has increased:

> … the objective of ecological management should not be ecological, but social: the overarching objective of ecological management should be to maximize human capacity to adapt to changing ecological conditions. … To maximize human capacity to adapt to changing conditions we must also maximize life's (or the biosphere's) capacity to adapt to change. (Reid, 1994, p. 10)
>
> … biodiversity conservation is a socio-political process as much as it is a scientific one. (Sarkar, 2005, p. 148)

The aim of conservation science is to support human decisions about interacting with the natural environment. Much of the work of conservation scientists consists of gathering information and developing tools to support about the nature and timing of management interventions (Courtney, 2001; Heagney, Ling, Alexander, & Saintilan, 2011; Y. Liu, Gupta, Springer, & Wagener, 2008; Pettit et al., 2008; Pielke, Sarewitz, & Byerly, 2000; Potter, Byrd, Miller, & Kochut, 1992; Shen, 1987; Williams & Johnson, 2013). Some of these tools are highly technical in nature, such as algorithms and models to provide population estimates or predictions of changes in climate and vegetation, and are intended to provide evidence that can be presented to managers and policy-makers mainly on trust – that is without a full understanding of the methodology used to achieve the

results. Others, such as use of scenarios and backcasting [13], are meant to be used in collaboration with non-scientists as part of a planning process. Cook has described ten approaches that fall into this second category, calling for their use in developing 'decision triggers' that link environmental data to management action (de Bie, Addison, & Cook, 2018).

Given that conservation science is a relatively new discipline, established in the 1980s, much of the data and analysis used to feed its work comes from the biological fields of botany, zoology, and its 'mother' discipline of ecology – fields that are more focused on basic generation of scientific findings that describe the workings of nature. Conservation biology was considered born as a discipline in 1985, with the founding of an association and journal. Between 1985 and 1987 it emerged as an 'organised academic discipline'. 'Biodiversity' as a term entered as the focus in 1988 (Sarkar, 2005, pp. 146–147).

The primary focus of conservation biology was on species, genetic, and ecosystems diversity:

> Conservation biology is far more than just knowing where species live, listing what is under threat, and making generalised statements about populations. It means well-planned genetic, demographic and ecological research. It means understanding the extremes of commonness and rarity. It involves quantitative, long-term studies of target individuals, and their biological characteristics and environmental responses (Given, 1993, p. 58).

Even with its emphasis on population and ecological studies, it was acknowledged that conservation biology was a value-laden field, based on the assumption that biological diversity was good, and should be preserved. It emphasised interdisciplinary work. The new discipline was characterised by controversy, and acknowledged responsibility for influencing policy:

> Friction … reflected deeper tensions in conservation: between sustainable use and protection; between public and private resources; between the immediate needs of people, and obligations to future generations and other life forms (Sodhi, 2010, pp. 14–17).

In 1989 Soule and Kohm had identified research priorities for the new discipline, including extensive biological surveys (Michael Soule, Kohm, & Society for Conservation Biology, 1989, p. 73). Their update in 2000 showed just how much the understanding of nature, and peoples' relationship to wilderness, had changed in the intervening years, with many of the themes relating to the study of change, and its drivers.

> …conservation practitioners need information on how ecological systems work, how the interaction among species determine the functional properties of the systems, and the spatial and temporal scales at which they operate. They need to know how much of what kinds of perturbations ecological communities can absorb, the consequences of ecosystem

[13]A method to analyse future options by indicating a desired state and working backward to determine the actions necessary to achieve it (Dreborg, 1996).

> fragmentation, and how and why introduced species alter ecosystems. (Michael Soule & Orians, 2001, pp. 2–3)

Looking at how research findings based on these areas of interest get into use through policy or practice, Sullivan et al. (2016) adapted the Cambridge Conservation Forum's classification of conservation actions to evaluate the use of crowd-sourced bird observation data. They focused on those actions they could describe as tangible conservation outcomes:

- research and monitoring: contribution to data needed to inform conservation decisions
- conservation planning
- site/habitat management
- species management
- site/habitat protection
- law, policy and regulation.

Because they considered the following not tangible, they left them out of their study:

- awareness raising
- law enforcement and prosecution
- livelihood, economic and oral incentives
- education and training
- institutional development.

They also identified products that they considered evidence for impact or use:

- management plans
- maps or data visualisations
- publications
- databases
- Environmental Impact Assessments
- decision support tools
- posters or presentations
- publicly available checklists
- outreach materials
- policies or regulations
- grant proposals
- status reports for listing/delisting species
- curriculum materials
- conservation easement justifications
- mobile software applications
- interactive exhibits.

The gradual movement of conservation biology studies to include application of their scientific findings to wildlife management has been documented by Cronin et al. (2014) in a 20-year assessment of the peer-reviewed wildlife conservation literature that identified wildlife/adaptive management, hunting/bushmeat, and human wildlife conflict as contemporary research priorities (Cronin et al., 2014). Acknowledging influences from disciplines and methodology outside

traditional ecology and zoology, literature increasingly refers to conservation science rather than conservation biology.

3.3.2.1 Adaptive management as an important concept in conservation science

A key concept in conservation science when looking at the uptake and use of research in relation to wildlife management is adaptive management. Adaptive management, an approach increasingly popular since the 1970s, refers to an iterative process of testing management interventions and feeding what has been learned back into the work, incorporating appropriate changes (Riley et al., 2003). The approach is especially relevant to conservation science research uptake because it takes the complexity of ecosystems into account and implies that new knowledge is being put to use in a fairly direct and instrumental way.

Salafsky et al. (2001, p. 12) defined adaptive management in the following way: "Adaptive management incorporates research into conservation action. Specifically, it is the integration of design, management, and monitoring to systematically test assumptions in order to adapt and learn." They emphasised that collection of data for adaptive management should be limited and targeted, and that communicating the results of research was an essential part of the process (Salafsky et al., 2001, p. 12).

Stirzaker et al. (2011) also pointed out that this approach should not be considered simple trial and error, but rather should integrate existing information from different disciplines and points of view, identifying knowledge gaps, and producing an 'intellectual paper trail' that provides evidence of the reasoning process behind interventions. They suggested that adaptive management is most successful when organisations have a culture of "… ongoing and purposeful learning with all relevant stakeholders ….", and when scientists are willing to fail (Stirzaker, Roux, & Biggs, 2011, p. 1).

There have been many calls for the application of adaptive management to conservation work, but, in a 2013 review, Rist et al. (2013) pointed out a lack of clarity and agreement as to its meaning, calling for better definitions, and systematic assessment of the approach (Rist, Campbell, & Frost, 2013). Pullin has argued that managers rarely have the time to set up the experiments that adaptive management requires, "… with appropriate controls and sample sizes. It would be much more efficient to base decisions on information that already exists" (Pullin, 2002, p. 307).

Nevertheless, the concept of adaptive management appears to suit the complexity and uncertainty of conservation work, and the need for research results to be taken up as part of the learning processes increasingly called for in the literature (Fazey et al., 2012; Iftekhar, 2015; McCarthy & Possingham, 2007; Walsh, Dicks, & Sutherland, 2014; Walsh, Wilson, Benshemesh, & Possingham, 2012; West,

Schultz, & Bekessy, 2016; Williams, 2015). Collaborative adaptive management has been put forward as an iterative process that requires ongoing exchange of knowledge among wildlife stakeholders. Joint data collection efforts, and rapid sharing of new information are important to the success of this approach. This means that these stakeholders – government managers, academic researchers, private sector practitioners, and members of the communities that live among wildlife populations – should interact and routinely share observational data and insights (Hull, 2009; Susskind, Camacho, & Schenk, 2012).

3.3.3 Identifying criteria for research uptake in conservation science

> … conservation success is directly correlated with basic management activities (Beale et al., 2013, p. 230).

Given the applied nature of conservation science, it should not be surprising that its literature has examined in detail the challenges of informing the policy and practice of wildlife management. Calls for more use of scientific research findings in management of natural resources are many (Knight, Cowling, & Campbell, 2006; Legge, 2015; Mills & Clark, 2001; Waddell, 2001).

On a broader scale, there have been ongoing efforts to study the challenges to uptake of environmental information. The Global Environmental Assessment Project (GEAP), for example, carried out under US National Science Foundation funding from 1995 to 2006, investigated factors that influence effective mobilisation of the scientific information provided by international integrated environmental assessments. The study found that assessments failed when they had been produced without request from a body, when they did not address the needs of potential users, when they did not integrate an ongoing process of communication in their production, and when they did not connect local concerns to global issues. The study did find successes: "… assessments can and do exert their immediate impacts – if any – in a variety of ways. The particular paths of influence are a matter for empirical investigation rather than definition or assumption" (Cash & Clark, 2001, p. 3,5).

The GEAP recommended, in response to these issues, better integration of science and decision-making through a social communication process, and of balanced consideration of social and bio-geophysical factors. Reports of the project were among the first to use the terms, *salience*, *credibility* and *legitimacy*, to describe key factors needed to ensure successful uptake of scientific findings:

> 'Saliency,' as we use it, is meant to capture the perceived relevance or value of the assessment to particular groups who might employ it to promote any of the policy changes noted above. 'Credibility,' as we use it, is meant to capture the perceived authoritativeness or believability of the technical dimensions of the assessment process to particular

> constituencies. 'Legitimacy,' as we use it, is meant to capture the perceived fairness of the assessment process to particular constituencies. (Cash & Clark, 2001, p. 6)

The study also identified key characteristics of potential users of environmental assessments: *interest*, *capacity* and *openness*, and emphasised the importance of timing. The study of Langer et al. (2016) used similar categories, that described three components of behaviour change: capability, motivation, and opportunity to use evidence, pointing out that any uptake of research was dependent on at least one and, often, more than one of these (Langer, Tripney, & Gough, 2016, p. 41).

The literature of research uptake and utilisation in conservation science can be categorised by using the following questions:

- Awareness: do potential users know the research exists?
- Relevance: do potential users think the research relates to what is important to them?
- Trust: do potential users think that the research findings are believable?
- Understanding: do the findings make sense to potential users?

These categories can be represented in the format of a decision tree that shows a possible progression of criteria that leads to research use. The following Figure 3-1 may help in visualising the relationship of these complex, non-linear processes.

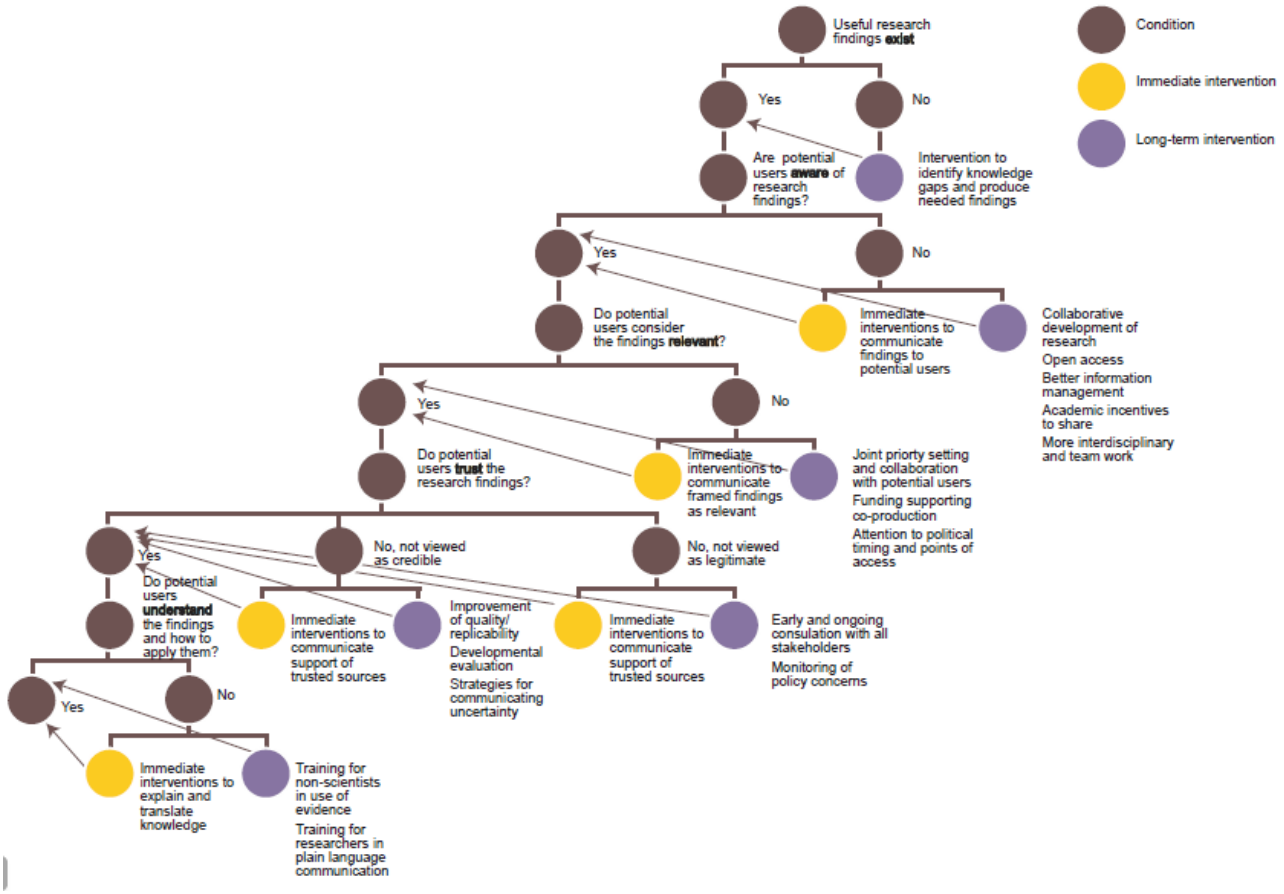

Figure 3-1 Decision tree for research uptake[14]

Note: Figure may be enlarged through zoom in Word or in PDF

Viewing the challenges to uptake of conservation science research through these categories reveals a recurring pattern: interactions between researchers and the stakeholders of research efforts appear to improve the functions they represent, and, by extension, the uptake and use of research.

3.3.4 How knowledge exchange in conservation science supports productive interactions

Studies of knowledge exchange provide a broader context for the productive interactions approach. Knowledge exchange is broadly understood to take place most effectively when people work together at the point of problem. Research collaboration does this, but it is also possible to plan 'boundary-crossing' type interventions that permit social learning (Creech & Willard, 2001; Cvitanovic, Hobday, van Kerkhoff, & Marshall, 2015; Fazey et al., 2012; Lawson, Hall, Yung, & Enquist, 2017; Phillipson, Lowe, Proctor, & Ruto, 2012; Romina, 2014; Stange, Leeuwen, & Tatenhove, 2016). Facilitating communities of practice that increase the contact and communication among relevant researchers and stakeholders produces opportunities for more productive interactions than might otherwise have taken place (Australia Knowledge for Regional NRM Team,

[14] Source: author's compilation

2009; Bruzzone, Larrue, Rijswick, Wiering, & Crabbé, 2016; Chapman et al., 2017; Kilvington, 2010; V. M. Nguyen, 2017; Sitas, 2014). These lead to realisation of the key conditions that support research uptake: awareness, credibility, relevance, legitimacy, trust, and understanding (Dunn & Laing, 2017).

Many theories of knowledge exchange can be related to the idea of communities of practice, where shared knowledge and joint experience constitute a common pool of expertise and, characterised by interactions among members of the group. Etienne Wenger (Wenger, 1999) defined three dimensions of a community of practice: mutual engagement, joint enterprise, and a shared repertoire. He saw these dimensions as nodes of communication, sharing the following qualities:

- ***Mutual engagement***: For participants, this means being included in what matters, sharing their diverse 'knowledges' and points of view, and building personal relationships.
- ***Joint enterprise***: People participate in a collective process to gradually define how the practice develops and create mutual accountability that becomes part of the practice. This requires participants to understand the enterprise well enough to take responsibility for at least some of it and contribute to it.
- ***Shared repertoire*:** Participants adopt a common language, symbols, and actions that are together a resource for the negotiation of meaning. A shared repertoire is based on a history of mutual engagement, and is ambiguous enough to allow participants to create new knowledge.

Wenger (1999) points out that communities of practice, by including some people and excluding others, can be sources of diverging practice. They also, however, function as connections that create continuity across boundaries.

The conservation science literature examining the processes of knowledge exchange has pointed out the need for a better understanding of most of these processes to enable better evaluation of their efficacy. A survey of environmental experts by Fazey et al. (2012) found that the scientists considered social learning, power relations, multidirectional information flow, and recognition of the dynamic nature of knowledge important in understanding these processes. The study concluded that an integrated research agenda that includes action research methodologies and embedding evaluation as a normal part of knowledge exchange research and practice need to be encouraged (Fazey et al., 2012). Cvitanovic et al. (2015) called for more quantitative evaluation that describes the traits that influence the effectiveness and efficiency – in the form of outcomes – of knowledge exchange activities, including the work of knowledge brokers (Cvitanovic, Hobday, van Kerkhoff, Wilson, & Dobbs, 2015).

3.3.5 Planned and unplanned knowledge exchange

Few conservation scientists have applied the concept of productive interactions directly to their work. Examples of those who have made specific reference to the approach in environmental

science, are the following: (Fritz, Rauter, Baumgartner, & Dentchev, 2018; Holzer, Carmon, & Orenstein, 2018; Maag, Alexander, Kase, & Hoffmann, 2018; Nagy et al., 2020; Schneider et al., 2019; Taylor et al., 2017). These and other conservation scientists have shown a strong interest in reflexive communication, knowledge exchange, and social learning among conservation partners as significant factors in promoting the uptake of research (S. Bell et al., 2011; Born, Boreux, Lawes, & Born, 2015; Cvitanovic, McDonald, & Hobday, 2016; Fazey et al., 2012; Hauck, Görg, Varjopuro, Ratamäki, & Jax, 2013; Hecht & Parkin, 2008; Hering, 2016; Lauber, Stedman, Decker, & Knuth, 2011; Nel et al., 2016; Nesshöver et al., 2013; V. M. Nguyen, Young, & Cooke, 2016; Noblet et al., 2013; Phillipson et al., 2012; Reed, Stringer, Fazey, Evely, & Kruijsen, 2014; Shackleton, Cundill, & Knight, 2009; Sterling et al., 2017; Toomey, 2015; Tschirhart et al., 2016; Wolf et al., 2013; Wyborn, 2015; N. Young, Nguyen, Corriveau, Cooke, & Hinch, 2016).

Many studies – like those of Spaapen et al. (2011), Spaapen and Van Drooge (2011), and Molas-Gallart and Tang (2011) – applying the SIAMPI approach, have looked at how large, planned, multi-actor research projects build opportunities for productive interactions into the work. Wall et al. (2017), in discussing translational ecology, also made the point that, "return-on-investment metrics for translational science is increasingly pointing to the conclusion that intentional, structured processes, boost the likelihood of science being successfully incorporated into environmental decision-making and policy" (Wall, McNie, & Garfin, 2017, p. 551).

Scholarly efforts to prescribe methods that result in effective knowledge exchange for environmental conservation work include the work of Reed et al. (2014), which has been applied and further developed in several case studies, based on the following principles:

- **Deliberate design:** incorporating knowledge exchange goals and plans in research project design from the beginning
- **Representation of user knowledge needs**: identification and inclusion of stakeholders in the research
- **Engagement**: building of trusted relationships with stakeholders
- **Consideration of impact**: early identification and sharing of impact with attention paid to timing
- **Reflection and learning:** regular analysis of knowledge exchange in the project, and sharing of learning (Reed et al., 2014).

Encouraging productive interactions in research projects can mean building facilitative mechanisms, such as consortium agreements, into project structures (Settele et al., 2010).

> From the initial scoping phase and into the program plan, the prospective adoption pathways for the research outputs of the program should be explored and mapped. … Assuming that the research program is focusing on a genuine knowledge gap that is constraining progress on a particular problem or issue, then it is a matter of working very hard with people to tease out research questions in a way that is meaningful to them. If end

> users can be genuinely engaged in this process in an interactive way, many of the subsequent adoption issues can be short-circuited. (Andrew Campbell & Schofield, 2007, p. 44).

Cvitanovic et al. (2016) identified deliberate interventions to facilitate knowledge exchange at three stages of conservation research projects: the development and design phase, the implementation phase, and the period following the conclusion of a research program. Their work identified the design and development stage as the most important for ensuring success of knowledge exchange, beginning with identification of all relevant stakeholders and their existing communities of practice (Cvitanovic et al., 2016).

Wenger (2011) argued, however, that building opportunities for multi-level interactions into research work did not require excessive structuring:

> A common mistake in organizations is to assume that horizontal relationships lack accountability—and therefore that the only way to create accountability is to overlay vertical structures. Participation in a community of practice can give rise to very strong horizontal accountability among members through a mutual commitment to a learning partnership. Even a good conversation creates accountability, albeit of a temporal and tacit nature. Participants are held to an expectation of mutual relevance: they can't just go off into irrelevant topics or statements without violating such expectation. In its own ways, horizontal accountability is no less binding and operative than formal vertical accountability (Wenger, 2011, p. 13).

While recognising that deliberately planning for productive interactions should be part of research project design, some scholars have looked at smaller scale, sometimes unplanned, individual, and informal interactions as an important part of research uptake. Smith et al. (2016) pointed out that there were cases in which individual scientists needed to interact directly with stakeholders, recommending support and incentives from their institutions to ensure this (Smith, Suldovsky, & Lindenfeld, 2016).

Moore et al. (2011), in their study of collaboration between the United States Fish and Wildlife Service and the U.S. Geological Survey, also reported roles in which individual interactions led to successful implementation of the work of adaptive management, namely that of team leader, technical specialist, and facilitator:

> While each was a specialist in his area, each could converse with the other, but most importantly, each could communicate with the stake-holder group to extract the needed elements and to ultimately lead the group toward a decision framework. ... Successful collaboration depends on inclusive and regular communication among members of the project team and between the team and cooperators. Participants in the project educate one another in a process that continues throughout the entire project … (C. T. Moore, Lonsdorf, Knutson, Laskowski, & Lor, 2011, p. 1398).

3.3.6 Individual roles in knowledge exchange

Crouzat et al. (2017) identified six idealised scientific postures (pure scientist, science arbiter-guarantor, issue advocate-guardian, officer, honest broker and stealth issue advocate) for individual researchers spanning possible roles at the science-policy interface, calling for ecosystem services researchers to be aware of their attitudes regarding knowledge production and use, as these affect their interactions with stakeholders and their professional assessments (Crouzat et al., 2017).

Olmos-Peñuela et al. (2014) observed that that informal collaborations not officially recorded by an organisation are much more common than formal agreements, and that many collaborations remain informal over time. They called for inclusion of social engagement between academic researchers and potential partners of their research in the mix of policy instruments that support knowledge exchange (Olmos-Peñuela, Molas-Gallart, & Castro-Martínez, 2014). Their later study pointed out personal characteristics that motivated researchers' societal engagement, suggesting that these could be included as indicators of the likely uptake of research (Olmos-Peñuela, Benneworth, & Castro-Martínez, 2015). These findings and recommendations were echoed by Llopis et al. (2018), who looked at individual capacities, training and career trajectories, and motivations of researchers (Llopis, Sánchez-Barrioluengo, Olmos-Peñuela, & Castro-Martínez, 2018). A survey of environmental practitioners by Goggin et al. (2015) analysed the personal qualities of researchers that led to effective knowledge exchange:

> Practitioners mentioned nine common personal attributes of the scientist: a committed, dedicated and passionate person; a leader or champion; a rigorous expert; well connected to universities or other organisations; a clear and effective communicator; who understood the practitioner's aims, needs and constraints; who was accessible and flexible; could function as a knowledge broker and translate complex and technical information into simple terms; and was pleasant, personable and "easy to get along with" (Goggin et al., 2015, p. 1930).

Robinson-Garcia et al. (2015) suggested another way to capture researchers' individual interactions as a way of mapping the contexts of potential societal impact: the use of altmetric data to carry out network analysis of researchers and stakeholders. Their case studies of Twitter data indicated the potential of measuring disparate degrees of policy engagement of researchers (Robinson-Garcia, Leeuwen, & Rafols, 2015).

The experience of SIAMPI and studies of knowledge exchange provide an opportunity to examine processes of conservation science uptake, where the following types of interactions take place.

3.4 Types of research-stakeholder interactions relevant to conservation science in Botswana

Even the most curiosity-driven research cannot take place without interactions, but not all interactions can be considered productive. Expanding the Spaapen and Van Drooge (Spaapen & Van Drooge, 2011, p. 212) criterion for a productive interaction, that it "… leads to efforts by stakeholders to somehow use or apply research results or practical information or experiences", to include active sharing of what has been learned so that the knowledge moves further into circulation, makes it possible to identify the types of interactions in Botswana conservation science that are more likely to lead to uptake. These include development of fresh research capacity through training and support of new graduates, collaboration between and among researchers and stakeholders, public outreach, consultations, and funding mechanisms.

3.4.1 Student training and capacity development

Transferring knowledge through formal education and training channels can be considered an important productive interaction as this results in further use of research (Courter, 2012; Duchelle et al., 2009; Latimore, Dreelin, & Burroughs, 2014; Margles, Peterson, Ervin, & Kaplin, 2010; Pardini, Rocha, El-Hani, & Pardini, 2013; Pietri et al., 2013; Toomey, Knight, & Barlow, 2016). Much of the biodiversity research that takes place in northern Botswana is carried out by students, under the direction, supervision, and mentorship of senior scholars. Their interactions – the iterative exchange of methodology and practical field experience – are potentially strong indicators of research uptake. Although these student stakeholders are considered academic researchers themselves, they often carry out their work as part of NGO interventionist programmes and projects that are oriented to application.

Training workshops are common when research takes place in project settings. They are perhaps the most common formal knowledge transfer activities that engage government practitioners in Botswana, providing opportunity for productive interactions between researchers and stakeholders (Morrison, 2014, p. 13), as the aim of these workshops is usually application of knowledge to change in practice and behaviour.

Citizen science has a long history in Botswana, with the contributions of amateur naturalists the foundation of content in the country's long-running journal, *Botswana Notes and Records*, for example. This natural history tradition continues strong in northern Botswana, with web-based interest groups for sharing of photographs of mammals, insects, and birds, and public participation in annual bird counts. Added to this is the online activity of thousands of tourist photographers who contribute records to services such as *Snapshot Serengeti* and *iNaturalist*, creating the potential for many indirect productive interactions between researchers and non-scientists. Recently added to the

mix is the contribution of wildlife monitoring through the type of 'voluntourism' described in Section 2.5.1: students and travellers who pay to observe and take part in wildlife research and management activities (Barnard, Altwegg, Ebrahim, & Underhill, 2017; Burke & Heynen, 2014; Chapron, 2015; Conrad & Hilchey, 2011; Convention on Biological Diversity Secretariat, 2015; Couvet, Jiguet, Julliard, Levrel, & Teyssedre, 2008; Fischer, 2000; Hulbert, 2016; Robertson & Hull, 2003; Steger, 2014; Talwar, Wiek, & Robinson, 2011; Villasenor, Porter-Bolland, Escobar, Guariguata, & Moreno-Casasola, 2016).

Internship and professional exchange – temporary assignment of students and practitioners to research projects, or of researchers to management settings – can produce valuable productive interactions through both formal and social learning. Embedding or movement of personnel can be a deliberate, project-related practice, or the natural outcome of a small pool of expertise that moves among sectors, as it is in Botswana (Barugahara & Harber, 2017; Carden, 2009; Jolibert, 2012; Roux et al., 2019).

3.4.2 Collaboration

Joint priority-setting, data collection and sharing, co-design of methods, cross-sectoral, transdisciplinary problem solving, and co-publishing are collaborative activities that can facilitate productive interactions.

3.4.2.1 Joint priority setting and co-design of methods

Many scholars have pointed to the way research is carried out – its funding mechanisms, academic reward and incentive systems, its reductionist approach, and its focus on narrow disciplines – as a significant barrier to its uptake (de Jong, 2015; Edwards & Roy, 2017; Esler, Prozesky, Sharma, & McGeoch, 2010; J. Newman, Cherney, & Head, 2015; Steel, List, Lach, & Shindler, 2004; Thornhill, 2014). Conservation science has its own frames of reference and methodologies that may make uptake more challenging. Collaboration with stakeholders – especially with practitioners and stewards of wildlife – in setting of research priorities and methods provides an opportunity for productive interactions.

Decisions about what gets studied are often made without consideration of the needs of potential users and priorities of managers. Setting priorities for research in conservation science is closely related to issues of relevance and fitness for use of information and data.

Game et al. (2013) identified common errors of scientists engaged in priority setting for conservation. These included:

- not acknowledging conservation plans as prioritization exercises, with accompanying resource allocation issues

- not working in close partnership with decision makers from the very outset to clearly define problems
- prioritizing species, habitats, or locations instead of actions
- unacknowledged bias, not clearly indicating the role of experience, opinions, and values in setting priorities (Game et al., 2013).

Underwood (1995) posited that the work of ecologists frequently missed being relevant to management because it was carried out in isolation from the needs of environmental management:

> We need a better understanding by managers about the sorts of research we must do to allow proper predictions. Until then, there must be much more ecological research into the outcomes of managerial decisions, as tests of the predictions and hypotheses made in the formation of the managerial policies (Underwood, 1995, p. 232).

He argued strongly for advice from ecologists in defining the "scale and scope" of environmental problems, expressing concern that much policy, some legislation, and many management decisions were made without this advice, mainly because the scientists were reluctant to take on the role of educators, or to engage in what they felt was outside their area of solid expertise: the use of their research findings (Underwood, 1995, p. 233).

Evidence gap mapping is closely linked to priority setting by conservation scientists, but also seeks to incorporate the needs and views of other stakeholders by offering them a picture of what might be done to address their needs. The approach addresses the issue of research relevance directly by focusing on research required for application to problems (Snilstveit, Vojtkova, Bhavsar, & Gaarder, 2013).

Scholars working in biodiversity informatics have called for a demand driven approach to prioritising publication of data through exposure of metadata to alert potential users to the existence of datasets, then responding to inquiries about the metadata by prioritising digitisation – and by extension accessibility for research – of the collections identified in this way (Berents, Hamer, & Chavan, 2010).

Chapter 2 has shown that in Botswana, identification of research priorities in development of iterations of the national wildlife research strategy, while led by scientists, has been carried out through a consultative process. Deep understanding and acceptance of the elements of these strategies by a broad cross-section of stakeholders, however, did not necessarily result. Braunisch et al. (2012) surveyed conservation practitioners to discover their research priorities, finding that questions about economic, societal and stakeholder conflicts were found to be more important than conceptual questions. While supportive of more interactions between scientists and users of research, their study cautioned that new and very technically-oriented investigations, such as those

supported by genetics science, might be neglected if priority setting depended only on the opinion of practitioners (Braunisch et al., 2012).

3.4.2.2 Data collection and sharing

> … the study of biodiversity is becoming an ever-bigger research enterprise. The database is (more than ever) cumulative, the analyses more ambitious and involving more people (Purvis & Hector, 2000, p. 218).

Reviews of the conservation science literature have shown that research in this field has grown steadily, and become increasingly collaborative (X. Liu, Zhang, & Hong, 2011).

It has been suggested that how biodiversity data are captured, preserved and shared influences their use. Geoffrey Bowker noted that understanding the scientific methodology, terminology, and assumptions associated with collected data, especially legacy data, is needed to ensure the data's persistence and utility. The context of data collection is important, and context can be understood through interactions experienced by collectors:

> … raw data enfolds just as many layers of organizational and social decision-making as the scientific texts that we more generally analyse. … If a legacy data store does not retain its own context as a formally separable set of entities then it is useless. (Bowker, 2000, pp. 665, 662)

> Data in the database are the result of a multitude of negotiated processes from sampling design choices to data collection methodologies, from calibration issues to quality assessments, from analysis algorithms to data presentations, from conceptual mappings to knowledge synthesis. From the diverse flows of information, forms of knowledge, and interrelationships between them, the view of an information ecology as an open system arises. (K. S. Baker & Bowker, 2007, p. 141)

One such *negotiated process* is development of boundary-spanning tools such as indicators (Pülzl & Rametsteiner, 2009; Turnhout, 2009), and frameworks to set their complex research in a more practical context. This helps to make their findings more easily understood by non-specialists and applied by practitioners: "… indicators are at heart a communication tool" (Walters & Scholes, 2017, p. 301).

Biodiversity indicators are constructed measurements designed as a communication mechanism to help people understand when a critical threshold or "tipping point" has been reached, an improvement achieved, or a condition worsened. The importance of aligning biodiversity indicators to the drivers of ecological change has been emphasised by scientists across the conservation science literature (Rapport & Hilden, 2013; Sarkki & Tinch, 2011; Turnhout, Hisschemöller, & Eijsackers, 2007). Without the critical link to a causal factor (erection of fences on migratory routes, for example) the indicator (number of zebra foals accompanying adults at end of breeding season) is

unlikely to be meaningful to a manager or local community member. It has not been provided in context, and so lacks instrumental usefulness.

It is clear that biodiversity indicators are by nature a key element in the conservation science research uptake process. They have been called 'boundary objects' by researchers looking at how they can translate scientific concepts for the people who manage a resource. This approach visualises a boundary area where indicators are the product of joint knowledge production:

> A possible perception of the relation between science and policy involves the notion of knowledge transfer. Under this perception, ecological indicators arrange the transfer of scientific knowledge by selecting, integrating and translating scientific knowledge into usable knowledge for policy. … Ecological indicators are the result of science policy boundary work. Effective ecological indicators are boundary objects. (Turnhout et al., 2007, pp. 220, 222)

Involving decision-makers in the process of developing indicators, argue some scholars, increases the likelihood of their being understood and put to use (Reed, Fraser, & Dougill, 2006; Rochette et al., 2018; Walters & Scholes, 2017, p. 303).

Hill et al. (2016) pointed out that applying multiple biodiversity indicators could lead to confusion among users, recommending a narrative model to pull the indicators into a framework. Van Oudenhoven et al. (2018) added feasibility to the criteria of credibility, salience, legitimacy as necessary ingredients of indicators that would convey meaningful information to stakeholders. Reed et al., in 2008, began recommending participatory development of indicators with stakeholders, saying that working together to combine scientific rigour with local knowledge would obtain the most understandable results (Reed, Dougill, & Baker, 2008).

Chapter 2 makes reference, for example, to a USAID-sponsored programme that, in collaboration with stakeholders, developed wildlife monitoring guidelines with indicators for commercial safari guides at Okavango Delta lodges (Bourquin & Brooks, 2014). Whether co-produced with stakeholders as a direct interaction or developed for the purpose of practical sense-making for a management plan for use as an indirect interaction, indicators can be viewed as a useful tool in facilitating uptake of conservation research through productive interactions.

3.4.2.3 Transdisciplinary co-production of research

Transdisciplinary research moves beyond creating multi-disciplinary teams to including non-academic stakeholders in the work, setting the stage for more productive interactions. In recent years, as the complexity of conservation work, particularly in the face of rapidly changing land use and climate change, is recognised, there has been much scholarly work calling for transdisciplinary research in which other stakeholders join researchers to produce studies that are relevant to local

problems. These include extensive discussion of the nature of interactions within such teams of people with different backgrounds and agendas (Bieluch et al., 2017; Cockburn, 2018; Healy, 2019; Holzer et al., 2018; Klenk & Meehan, 2017; Schneider & Buser, 2018).

A study by Fazey et al.(2005) reviewed the publishing patterns of researchers in three major conservation science journals. They found that, "Despite assertions in the literature that conservation is synthetic, eclectic and multi-disciplinary, few studies were truly cross-disciplinary (13%)" (Fazey, Fischer, & Lindenmayer, 2005, p. 63). Their findings prompted recommendations for researchers to broaden the number of habitats, taxonomic groups and scales studied and provide closer and clearer links with other disciplines and research approaches, and with policy and management.

In 2015, Velasco et al. published a similar study, covering the years 2000 and 2011. Over ten years, they found an increase in multi-disciplinary and management studies. They noted a paucity of studies of human social processes and behaviour, and made recommendations similar to those of Fazey et al. for more diversification (Velasco et al., 2015). Di Marco et al., in their 2017 analysis of 30 years of conservation publishing, summed up these concerns about bias:

> We argue that conservation science should not be simply aimed to increase the level of knowledge so it is proportional to the biodiversity asset or state (such as the number of threatened species in a group). It should ideally relate to an expected value of information — the expected net benefit of the new information in terms of changing actions or policies on the ground (Di Marco et al., 2017, p. 40).

Transdisciplinary research includes both the knowledge of other academic disciplines, and that of stakeholders outside the academic fold. The broad trends described by Nowotny et al. as a movement toward the 'social distribution of knowledge' to create 'Mode 2' science are also observed in conservation science.(Nowatny, Scott, & Gibbons, 2003). Conservation scientists are increasingly recognising that their work is social, and that they must use the understanding that comes from the people who live and work in the natural environments they study. This involves productive interactions with researchers from the social sciences and humanities, and with local people (Bennett et al., 2017; Couix & Hazard, 2013; Görg et al., 2014; Holzer et al., 2018; Klenk & Meehan, 2017; Meinard & Quétier, 2014; Polk, 2015; Reyers, Nel, O'Farrell, Sitas, & Nel, 2015; Specht, Gordon, Groves, Lambers, & Phinn, 2015; M. A. Thompson, Owen, Lindsay, Leonard, & Cronin, 2017). The Okavango region is an example of a study area especially suited to transdisciplinary work, with ecologists needing access to the findings of water engineers, meteorologists, anthropologists, and geologists, as well as the local knowledge embedded in communities.

But it is not only knowledge from varied sources that is needed to produce research that is both useful and used: people from these groups actually need to work together at a point of problem, in a learning process, to produce robust productive interactions. Research uptake scholars agree that meaningful collaboration throughout the life cycle of research is the most powerful way of getting that research into use so that it can have impact beyond the academy (Aydinoglu, Allard, & Mitchell, 2016; Cullen et al., 1999; Mattessich & Monsey, 1992; Perez Vico & Hallonsten, 2017; R. S. Reid et al., 2016; Stange, 2017).

In northern Botswana, development programmes and projects can provide examples of collaborative setting of research priorities and methods, as development aid partners are increasingly including these processes in their funding requirements (B. Carter, 2017; Independent Commission for Aid Impact, 2015; L. Jones et al., 2018; Tilley & Cao, 2017; USAID, 2016). These productive interactions are likely to increase relevance, trust and understanding (S. M. Alexander, Andrachuk, & Armitage, 2016; Ashley, Kenton, & Milligan, 2006; Balme, Lindsey, Swanepoel, & Hunter, 2014; Balram, Dragićević, & Meredith, 2004; Braunisch et al., 2012; Jo Cooke, Ariss, Smith, & Read, 2015; Cvitanovic et al., 2016; Guerrero & Wilson, 2017; Kilvington, 2010; Knight, Cowling, Boshoff, Wilson, & Pierce, 2011; Laurance et al., 2012; López-Bao, Chapron, & Treves, 2017; McNie, 2007; A. Nguyen, Hirsch, Adrian-Kalchhauser, & Burkhardt-Holm, 2015; Russell et al., 2015; Sheppard & Meitner, 2005; Sutherland, Fleishman, Mascia, Pretty, & Rudd, 2011).

Joint production of scholarly research papers with foreign researchers, local researchers, and local practitioners as co-authors has been common in northern Botswana for some years, as it is in many developing country settings (Boshoff, 2010; Western, 2003). There is now a global movement to acknowledge the contributions to the research of a broader group of contributors – such as guides, interpreters, and data collectors – especially as access to data collected is made more accessible (Foster et al., 2018; Habel et al., 2014; Hobern et al., 2019; Huang et al., 2012). Being acknowledged in publications and other sharing of research results is a form of productive interaction that seems likely to lead to increased uptake through creating trust (Duke & Porter, 2013; Stocks et al., 2015; Toomey, 2015).

3.4.3 Public outreach

Deliberate efforts to share knowledge about research activities and findings with stakeholders beyond academia are among the most easily acknowledged and tracked productive interactions. These build awareness by helping potential users know the research exists, expose opportunities for collaboration, increase relevance by helping researchers learn what potential users think is important to them, build trust through creating and strengthening relationships and exposing researchers to public policy concerns, and increase the potential for understanding by giving

researchers practice in communicating with non-scientists (Bradshaw & Borchers, 2000; Kahan, 2010; Kakonge, 2013; Norton, 1998; Pace et al., 2010; Peoples, Midway, Sackett, Lynch, & Cooney, 2016; Saunders et al., 2017; Schiller et al., 2001; Shanahan, 2008; Siepen & Westrup, 2002; South African National Biodiversity Institute, 2011; Szucs, 2005; Thakadu, 2011; Twine, Kahn, & Lewando Hundt, 2017; Valiverronen & Hellsten, 2002; Varner, 2014; Wright et al., 2015).

Presentations and lectures, media exposure, production of popular knowledge products and environmental education materials, and social marketing provide opportunities for productive interactions (Tindal, 2016). An example of such work in northern Botswana is the monthly *Research Talks for Everyone* event organised by the Okavango Research Institute and sponsored by local tourism operator Kwando Safaris. Running now for more than two years, the event presents the findings of northern Botswana studies to a mixed audience of tourism industry employees and service providers, NGO staff, visitors, other researchers, and some government officials (Pfotenhauer, 2017). Chapter 6 of this thesis describes this event in more detail.

3.4.4 Consultations

Participation in formal or informal consultative processes – sometimes referred to as part of the Science-Policy Interface (SPI) – has potential for productive interactions that lead to impact in the policy realm (Sarkki et al., 2015; J. C. Young, Watt, & van den Hove, 2013). The science-policy process is multi-directional: researchers can both provide expert advice and input to policy and planning processes and receive inputs to their research from stakeholders. Since formation of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) in 2012, whose stated goal is "… 'strengthening the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development'" (Díaz et al., 2015, p. 3), studies of how best to structure and plan these interactions have reflected previous research findings about research uptake in conservation science (Matsumoto et al., 2020).

Consultative workshops for stakeholders can be a rich source of knowledge that feeds into the research process, provided that the workshops are focused on specific issues, and provide channels for follow-up interactions (Knight, Driver, et al., 2006; Michel, Heim, Herweg, Zimmermann, & Breu, 2010; Slunge, Drakenberg, Ekbom, & Göthberg, 2017). Again, capture of productive interactions at such, more formal, events is usually possible.

Extended peer review[15] – a researcher-stakeholder interaction – introduces socially relevant knowledge to research findings, as stakeholders have the opportunity to include their understanding of the issues in research analysis (Charnley et al., 2017; Cornell et al., 2013; Dicks et al., 2017; Funtowicz & Ravetz, 1993; Garritt, 1992; Görg et al., 2014; Heiskanen, 2006; Jolibert & Wesselink, 2012; Pregernig, 2006; Robertson & Hull, 2008, 2003; Rose, 2015; Soomai, 2017; Talwar et al., 2011; Tinch et al., 2016; Turnhout et al., 2007; Turnhout, Stuiver, Klostermann, Harms, & Leeuwis, 2013).

Public hearings and planning processes are opportunities for researchers to both include their specialist research knowledge in policy making processes and to learn more about stakeholder priorities. This includes participation in steering committees, and presentations to governing or management bodies such as parliamentary committees and commissions of inquiry (Bäckstrand, 2003; Bertuol-Garcia, Morsello, El-Hani, & Pardini, 2018; Ellis, 2012; Foote, Krogman, & Spence, 2009; Garrard, Fidler, Wintle, Chee, & Bekessy, 2015; Gill, 2001; N. Jones & Datta, 2011; Kakonge, 2013; Lach, List, Steel, & Shindler, 2003; Madhusudan et al., 2006; Mostert & Raadgever, 2008; Slunge et al., 2017; Wilhelm-Rechmann & Cowling, 2011; Wilkinson & Weitkamp, 2012). Because such processes are usually formally documented, interactions can be captured as part of the public record.

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Expert advice can be sought by stakeholders and researchers and is frequently traded in informal settings. Studies have shown that the most common source of information for non-specialists is other people, taking the form of direct contact to obtain advice or knowledge about a topic (R. W. (Bill) Carter, Hockings, & Cook, 2010; Gossa, Fisher, & Milner-Gulland, 2014). This persists even in the Internet age when access to specialised information is readily available (V. M. Nguyen et al., 2016). This type of interaction can be a first step in further use of research information, increasing its productive value. These exchanges are a potentially rich source of knowledge – truly productive interactions – but, because of their informal nature, are often not captured in documentation.

Formal use of expert advice, however, can take place in contexts where there is a high degree of uncertainly or perception of significant knowledge gaps. An example of this in northern Botswana

[15] Extended peer review includes relevant social actors in evaluation of research to contribute extended insights and knowledge (Guimarães Pereira & Funtowicz, 2006)

was the survey planning meeting held in Kasane with stakeholders and experts in 2014 for the Great Elephant Census, where methodology was discussed and disputed[16]. In these cases, the processing of advice can provide opportunities for multiple productive interactions that can be publicly recognised and documented (Martin et al., 2012; Meagher, Lyall, & Nutley, 2008; Runge, Converse, & Lyons, 2011).

3.4.5 Interactions facilitated by intermediaries

Many scholars have argued that intermediaries can play a useful role in ensuring that planned research is relevant to potential users by illuminating research context, identifying and engaging potential partners and stakeholders, and facilitating interaction (Michaels, 2009; Sitas et al., 2016; Turnhout et al., 2013; J. C. Young et al., 2016). This has promoted the concept of knowledge brokers: people or organisations that create connections between researchers and their various audiences (Meyer, 2010).

Shaxson and Bielak (2012) broke the roles of knowledge intermediaries into the following categories, linking these to indicators of achievement:

- Infomediaries: informing, aggregating, compiling, signalling information;
- Knowledge translators: Disseminating, translating, communicating knowledge and ideas;
- Knowledge brokers: bridging, matching, connecting, convening, linking, boundary spanning, networking and facilitating people;
- Innovation brokers: negotiating, building, collaborating, managing relationships and processes.

They wrote that analysing the degree of fragmentation or focus in the supply and demand for knowledge in specific contexts was necessary to determine the type of intermediary needed (Shaxson & Bielak, 2012).

In the context of conservation science, knowledge brokerage can take a variety of forms and processes, carried out by different types of actors. Reineike's analysis in 2015 of the relevance of climate knowledge brokerage to biodiversity pointed out the failure of what she called 'classical advisory formats' to influence policy, and the movement towards services that incorporate systematic review, extended peer review, knowledge translation, interactive capacity building, and personal consultation. Her work revealed that, in spite of general understanding of the need to incorporate concerns and views of multiple stakeholders and the experience of practitioners, most of the knowledge brokers studied adhered to a role of supplying or bridging knowledge, rather than facilitating understanding, "… counterproductive because it complicates the fulfilment of a truly hybrid role which actively internalizes and balances the political charge of knowledge" (Reinecke,

[16] Landen, K. (Personal communication, 2014)

2015, pp. 519–520). She further recommended that, before developing similar services for biodiversity management, the role of brokers and expertise be carefully examined.

Turnhout et al. (2013) looked at how the processes of "… informing, consulting, matchmaking, engaging, collaborating and building capacity might be employed in responding to different types of environmental policy problems or policy settings identified in decision aiding frameworks" (Turnhout et al., 2013, p. 354). They had also found that the roles of intermediaries varied by problem type and policy environment and had expressed concern about the persistence of a linear approach to scientific knowledge production and use among intermediaries.

Obermeister (2018), in the context of developing international biodiversity policy, emphasised the difference between brokering to help scientists understand one another across disciplines, and brokering between scientists and policy-makers, and as well between fact-finding and sense-making: these require different approaches and skill sets (Obermeister, 2018).

Wittmayer and Schapke (2014) saw the role of broker as just one of several that scientists themselves could adopt to facilitate communication of research in what they referred to as process-oriented sustainability science. Young and Marzano (2010) described the personal characteristics that make an effective knowledge broker in conservation science. Cvitanovic et al. (2017) pointed out the need to assess the effectiveness of knowledge brokers in facilitating , suggesting social network analysis for this purpose. Their Australian study found a positive impact for knowledge brokerage in the form of development of stakeholder networks, helping researchers understand how agencies operate, and how to engage with specific decision-makers. Maag et al. (2018), drawing from experience in both environmental research and management, and in public health, developed specific process indicators to measure the contribution of knowledge brokers to impact.

Sheate and Partidario (2013) while acknowledging the role of individual people and organisations in playing a brokerage role, urged consideration of processes such as strategic environmental assessment (SEA) as brokerage between scientists and stakeholders. They identified the following conditions for effective brokerage to take place:

- Range of stakeholders - the appropriate range of stakeholders needs to be engaged in the process;
- Opportunity space - resources, time and space need to be created for engagement and exchange of knowledge to take place;
- Conducive to knowledge exchange - that time and space need to provide a conducive, open-dialogue and non-judgmental environment in which that exchange can take place;
- Learning environment – conditions need to be established to enable creation and transformation of knowledge through learning processes;

- Receptiveness of proponent - a proponent will need to be alerted to the advantages of knowledge input to make him/her receptive to external inputs to ;
- Willingness to use of different knowledges - a proponent as well as the EIA or SEA/SA authorities will need to be actually willing to make use of other forms of knowledge (Partidario & Sheate, 2013, p. 29).

These conditions can be considered applicable to brokerage whether carried out by an individual or an organisation, as well as by a regulatory or management process.

In northern Botswana's wildlife research community of practice, the role of knowledge broker is probably most often taken up by NGOs and consultants. Both carry out applied research, sometimes on behalf of government and the private sector, and, as pointed out in Chapter 2, are staffed by professionals who move from one sector to another over time.

3.4.6 Funding interactions

Bespoke contract research, commissioned by government, development partner organisations, or the private sector, provides direct insight to issues considered a priority by potential users. Cooperating-partner funded project related research is a continuing source of new knowledge in Botswana (Morrison, 2014, p. 15; UNESCO, 2013). Productive interactions include activities directly related to finance, such as contracting, management of project grants, and sharing of facilities, and substantive inputs such as direction and provision of knowledge resources part of the research steering process (Evaluating Research in Context (ERIC), 2010; K. Newman, 2016; Shackleton et al., 2009). More incorporation of requirements for collaboration and developmental evaluation in funded programmes can lead to opportunities for monitoring of interactions (Arnott, Neuenfeldt, & Lemos, 2019; Craigie, Barnes, Geldmann, & Woodley, 2015; Hering, 2016; Michel et al., 2013; Rowe & Lee, 2012).

Michel et al. (2013) analysed research funding schemes to establish what worked to promote research-user collaboration, concluding that institutional capacity is needed to develop services that enhance the connection between researchers and research users. They recommended funding schemes based on principles of co-production of knowledge, coaching during project submissions to ensure selection of appropriate approaches, and identification of options for tapping the potential of the broad range of activities that foster learning across academic boundaries (Michel et al., 2013).

Campbell and Schofield (2007), drawing from their experience of funding and managing applied research with the Land and Water Australia programme, recommended careful consideration by funders of knowledge adoption pathways at the onset of research. They identified the following factors important in allocation of funding:

- depth of understanding of end user needs at a program level, and of the adoption context

- high quality partnerships, especially involving end users
- the relative ‘adoptability’ of the outputs generated by the program
- timing of outputs relative to the adoption context of the intended end.

3.5 Summary

This chapter has examined literature related to productive interactions as a conceptual approach to the study of research uptake, discussed the applicability of the approach in the field of conservation science, and explored the types of interactions that might lead to research uptake in northern Botswana.

The productive interactions approach can be seen to incorporate the learning and recommendations of studies of how to get conservation science into use. Establishing the conditions that scholarly research experience has shown to result in research uptake lays a foundation for interactions between researchers and stakeholders at all stages of the research process, supporting development of the awareness, legitimacy, relevance, trust and understanding needed to facilitate application of research results. Iterativity – the process of creating multi-way feedback – contributes to the repeated exposure in the adaptive management learning process central to the application of conservation science. Understanding these interactions as fundamental to knowledge exchange in communities of practice helps to point the way to deliberate planning of interventions that improve the uptake of research.

As a conceptual lens for studying research uptake the productive interactions approach is transformational in that it shifts the focus of studies from end results to processes, and from attribution to contribution. It also brings the importance of social learning to the fore, pointing out the need for evaluation systems to acknowledge the productive potential of interactions between researchers and research stakeholders.

While types of productive interactions vary considerably, most can be encompassed in what Nowatny et al. “a dialogic process, an intense (and perhaps endless) 'conversation' between research actors and research subject” (Nowatny et al., 2003, p. 187). While it may be possible for ‘one-off’ encounters to be productive, it is more likely that the ‘endless conversation’ referred to here will result in building of trust and capacity that can develop into a community of practice. This process does not always consist of exchange of knowledge between equals, however: the power relations embedded in specific social settings affects both frequency and quality of interactions. As indicated in Chapter 2 of this thesis, the physical remoteness of wilderness often sought by researchers, and political sensitivity of human-wildlife interactions, among other contextual factors that signal possible inequalities, need to be considered when evaluating the effectiveness of efforts to increase uptake of conservation science research.

A range of opportunities for productive interactions, both planned and unplanned, formal and informal, are present in Botswana for conservation science researchers and stakeholders willing to participate. Chapters 5 and 6 of this thesis provide empirical evidence that the productive interactions approach is a useful framework for understanding the workings of a wildlife research community of practice in northern Botswana, and for shedding light on how research findings make their way into uptake and use.

The following Chapter 4 describes methods relevant to this study.

Chapter 4 Methodology

> "… conservation is a social process that engages science, not a scientific process that engages society" (Toomey et al., 2016).

4.1 Introduction

This section provides some reflection about the motivation and approach to this thesis and an overview of the data and main types of analysis that were used. Potential limitations arising from the study's design, data availability, and analytical methods are also discussed.

The original question motivating this research came from my exposure to perceptions among non-academics in northern Botswana about the lack of usefulness of wildlife research carried out in the region to the needs of Botswana, and the corresponding lack of commitment shown by foreign researchers who came to Botswana to gain academic recognition in their own countries. At the time, in 2013, the issue of decline of mammal populations in northern Botswana's wilderness areas was highly topical, provoking the question, *With all the research data being collected, why is it not being used to manage wildlife populations more effectively*? I decided to investigate whether the questions underlying this question were justified, and any possible reasons for research findings not being put to use by the country's stewards of wildlife.

The research took a mixed methods approach, combining qualitative and quantitative analysis to explore conditions affecting the communication and uptake of northern Botswana wildlife research through literature reviews, field observations, surveys, interviews, and document content and citation analysis. The stages of research overlapped to some extent and were carried out against a backdrop of participant observation (Frydenberg, Eikenes, & Nordby, 2019) in northern Botswana over a five-year period, with reference to the framework of productive interactions in communities of practice.

The research for this work was carried out in two phases: exploratory context work, and data collection and analysis. An initial phase of exploratory work, carried out under an IDRC Communications Division doctoral research award in 2014, focused on the idea of a northern Botswana wildlife research community of practice in which researchers communicated their findings through interacting with potential users of research. As discussed in Chapters 2 and 5, boundaries between private and public sector roles of research stakeholders in the region have been permeable, so the concept of a community of practice in which research producers and users mixed socially and exchanged knowledge appeared to be relevant. A Government of Botswana research permit was obtained under the auspices of an existing NGO-based wildlife research programme,

and exploratory interviews with wildlife research stakeholders in northern Botswana were carried out to identify potential case studies related to my interest in the theory of community of practice, to determine whether these reflected engagement with local management priorities, A desk review of historical documents and studies related to wildlife surveys in the region was made to explore whether these reflected engagement with local management priorities, and to what degree these outputs had been captured by a key Botswana memory institution[17].

Findings from this initial phase of work led to further fieldwork that took on a participatory action research approach between 2015 and 2018, looking at whether two local structured platforms in the form of ongoing events organised to share and exchange research findings with stakeholders facilitated productive interactions. Following two years of recorded observations, a follow-up survey was carried out with participants from one of the events. This phase also included development and implementation, as principal investigator, of a small, funded collaborative project to capture and share local biodiversity data, and engagement with stakeholders to investigate implementation of collaborative wildlife monitoring programmes, and participation in local research workshops and seminars.

Two surveys carried out in 2018 explored interactions between researchers and research stakeholders in the regulatory process of the Government of Botswana intended to track independent research projects, and the previously mentioned jointly-sponsored research outreach event. Sources identified for the first survey were principal investigators who were issued Government of Botswana research permits between the years 1996 and 2014. The second survey was directed to participants in a joint university-tourism organised public research outreach event, *Research Talks for Everyone*, based in Maun, Botswana. Semi-structured interviews were carried out with researchers and research stakeholders associated with the two survey groups, or identified through community of practice activities such as workshops and meetings, referral, and publications. Specific content of graduate theses and dissertations that were outputs of the research permits studied was examined to enrich the findings from the research permit survey, and citation analysis enabled further understanding of the role of the Botswana-based research in capacity-building.

Throughout the study period, I attempted to apply the principles of the productive interactions approach, sharing interim observations and findings with the researchers and stakeholders studied through presentations at seminars and workshops and in social media channels.

[17] Memory institutions refers to organisations that maintain repositories of public knowledge, such as libraries, archives, herbaria, and museums.

Figure 4.1 provides an outline of how the research for this study was designed and evolved, and the following sections in this chapter provide more details about the methods used.

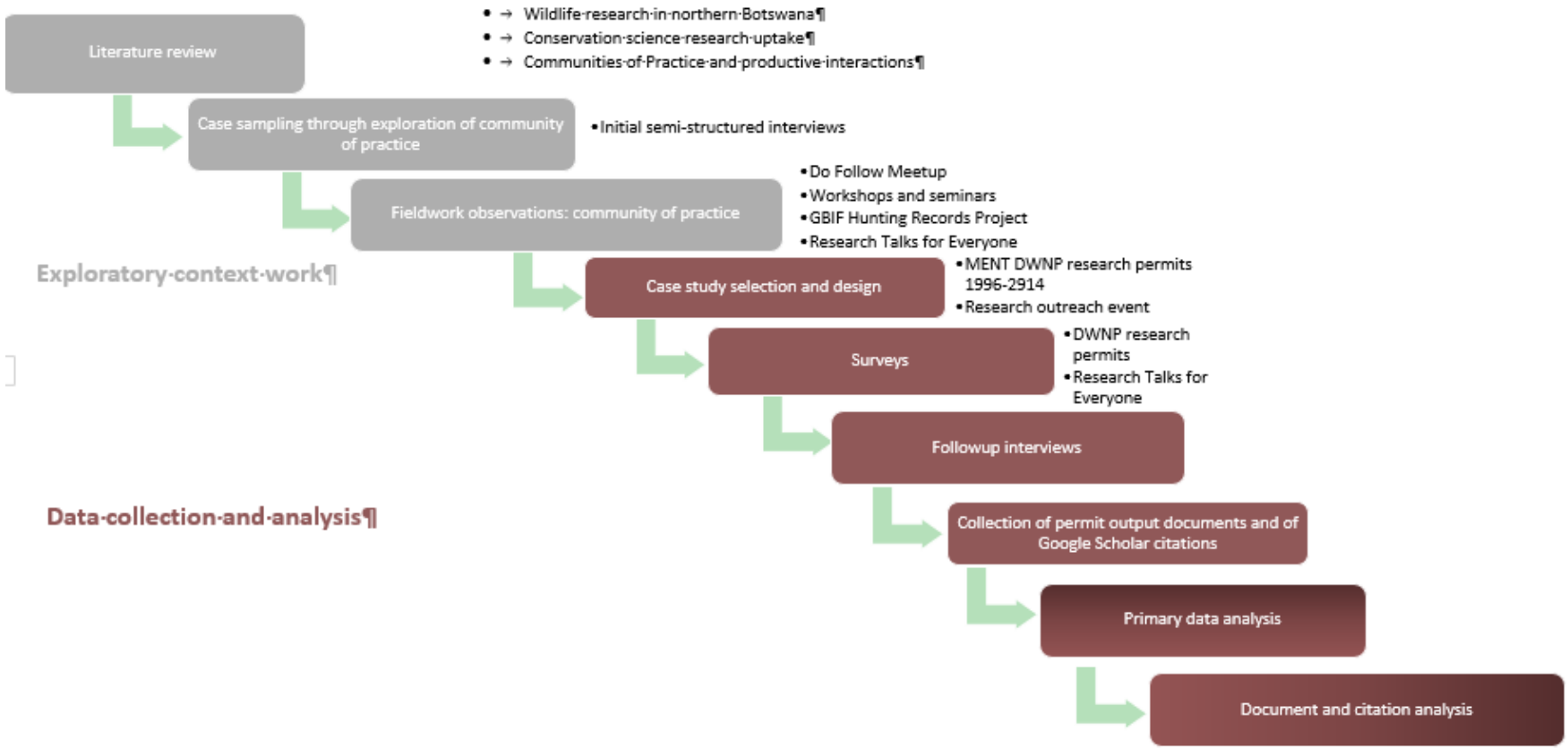


Figure 4-1 Phases of study

4.2 Exploratory context work phase

This phase of work reviewed the literature of Botswana wildlife research and of theoretical approaches to research uptake, and sought to identify potential case studies, that allowed application of the concepts explored. This section provides illustrations of the exploratory context work in preparation for Section 4.3, which will describe the three key study components of the thesis: a case study of Botswana government research permit work, a case study of a public outreach event, and an exploration of possible proxies to capture interactions and uptake in the form of capacity-building.

4.2.1 Review of Botswana literature on wildlife research

To understand the history of wildlife research in northern Botswana, a review of literature began with reading of reports, articles and books discovered through the library of the Okavango Research Institute in Maun, Botswana, with an eye to establish patterns of interaction and knowledge exchange among researchers and wildlife stewards. Some of these materials, such as the notebooks of the late wildlife ecologist Richard Bell, were in the library's archival collections, and some were obtained from the university library's Botswana special collection (BDSC) in Gaborone. The content of these materials suggested an evolution of engagement of government wildlife stewards in research planning and review. Chapter 2 of this thesis describes what I learned from this literature.

4.2.2 Exploratory work on a community of practice in northern Botswana

After obtaining a MENT research permit under the auspices of a Botswana NGO, Elephants without Borders, and research support granted by the International Development Research Centre, my Botswana fieldwork observations in 2014 were based on initial 24 semi-structured interviews with researchers, to explore the possible presence of a northern Botswana community of practice for wildlife research. Informants were asked about their motivation for their research, and about their interactions with potential users of their research. Preliminary interviews were also carried out with government officials, and with managers of the University of Botswana's library special collections to try to see how research findings were being shared, preserved, and accessed. These data were used to write an initial report that, referring to Nathan Caplan's two communities theory (Caplan, 1979), and to Etienne Wenger's theory of communities of practice (Wenger, 1999), set the stage for further investigation.

My early findings seem to indicate that communication of wildlife research was happening within a community of practice in northern Botswana. While it was possible to see the two communities

theory[18] at work in researchers' adherence to producing peer reviewed articles that are not easily accessed or understood by non specialist audiences, there was advice being sought across sectors, responses made, discoveries defended and outputs shared in a process that resembled the interactions of a large, somewhat unruly, and argumentative family. A flow of information takes place, even if it is not linear, or always predictable.

From these preliminary observations, it was evident that if there is a problem with communication and uptake of wildlife research findings in Botswana, the problem really is not at the level of researchers and technical managers who form the core of this community of practice. It seems to rather lie in uptake of the research at both ground level in the field, and at the policy enforcement level higher up in government. Perhaps the learning was not moving up or down to the policy-makers and practitioners on the ground.

My ongoing research then needed to look at whether and how communications from this core community of practice reach and penetrate the boundaries that separate its members from others in the chain of investigation and governance (Morrison, 2014). Recognition of this was to lead to adoption of the productive interactions approach, which supports investigation of the contribution to the uptake of research made by encounters and relationships.

4.2.3 Participation in Do … Follow Meetup event

As an IDRC Research Awardee in Ottawa in 2014, I discovered *Meetups* – informal meetings of interest groups with the organising made easier through a web app that allows groups of people with similar interests to participate in real life meetings. The app supports an organiser to manage a distribution list as well as to capture and preserve documents, pictures and online discussions. When on my fieldwork assignment in Botswana, interviewing wildlife scientists about the contribution of individual foreign researchers to the wildlife body of knowledge, I found that one of the voluntourism[19] organisations in northern Botswana, Wildlife Act, had made some efforts to provide an informal forum for visiting graduate students working on conservation topics in northern Botswana, but it had quickly lost momentum.

I decided to experiment with the idea again, using the online Meetup site. I set up the site in 2014, calling it *Do…Follow!* in response to the use of the rather discouraging *Do Not Follow* signs on

[18] The 'two communities' theory posits that the interests of scientists and policy-makers are so different that it is difficult for them to communicate with one another .(Caplan, 1979).
[19] A form of tourism in which travellers participate in voluntary work, typically for a charity. Oxford Lexico, 2020.

local research vehicles. There were three motivating factors for this intervention to support my work:

- To have a point of contact with the research community I was studying, since I was not myself a wildlife researcher
- To encourage conversations about production, sharing, and use of research findings
- To observe interactions among producers and users of research to provide context for other data I was collecting.

The intention was to focus on people who were engaged in research full-time, either as students, academics employed by institutions, consultants, project staff, or government officials, but to also include people who were not necessarily trained academics but who were enthusiastic natural history amateurs, or, as in the case of many tourism operators, supporters of research.

I had been following up holders of research permits from the Botswana Department of Wildlife and National Parks, so I used that list, as well as names from the University of Botswana's Okavango Research Institute and the Botswana Wildlife Training Institute to compile email invitations to 193 researchers. Twenty-seven percent of the people initially contacted – 52 of the 193 – joined the Meetup site after receiving an invitation. The first meeting was in June 2015, supported by the NGO, Elephants without Borders. It was an informal evening meeting at the Maun safari camp, Old Bridge Backpackers, with researchers invited to discuss their projects and concerns.

Figure 4-2 Do...Follow Meetup February 2017

It became clear after several meetings that researchers did not wish to only chat informally. In response, to add structure to the event, I began inviting a resource person to speak briefly about a topic related to the collection of data or use of research. Their presentation was followed by

discussion and informal exchange of news and opinion among the participants. I also set up and maintained a site on the Meetup web-based platform that was used to share summaries of the presentations and discussions, photographs, local research news, and comments. Table 4-1 includes examples of topics discussed.

Table 4-1 Some presentations made at *Do ... Follow* Meetup

Topic	**Resource Person**
Building awareness of government's wildlife research needs among researchers	Chief Wildlife Officer, DWNP
Preservation of legacy wildlife research data for reuse	Hunting association representative
Current wildlife issues with research priorities and processes	Regional wildlife officer
Research permit processes	National Research Coordinator, MENT
Discussion of international decisions for wildlife trade that affect Botswana	Hunting association representative
Building awareness of wildlife research data among policy-makers	NGO manager
Collection, preservation and use of vegetation biodiversity data	University herbarium researcher
Collection and sharing of wildlife monitoring data	Project manager
Interventions to resolve land-use problems in Ngamiland, including human-wildlife conflict	Project manager
Preservation and access for government environmental grey literature	Natural resource officer
Preservation and use of vegetation biodiversity data	Consultant
Production, preservation and re-use of monitoring data	University researcher
Collecting and using climate change data	University researcher
Research collaboration with local government in managing human-wildlife conflict	NGO researcher

Between September 2015 and January 2018 meetings were held once a month, with final membership of the online Meetup reaching 170 researchers and stakeholders. These meetings supported my study through enabling open dialogue in which information flowed among researchers and other participants at the meetings, and through electronic exchanges. This helped to identify interests and concerns of both researchers and research stakeholders, and to observe interactions among them in what had become in effect a boundary space for knowledge exchange.

4.2.4 Participation in Botswana workshops and seminars

Throughout the fieldwork period, I was invited to attend and participate in research-related events held in Maun and Gaborone. Some of the organisations hosting these events included the Botswana Department of Wildlife and National Parks, University of Botswana Okavango Research Institute, Botswana Ministry of Environment, Natural Resources and Tourism, Botswana Wildlife Training Institute (BWTI), and Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL). These events provided an opportunity, through participant observation, to understand the context of wildlife research in the region, to meet researchers for later follow-up, to see how researchers interacted with stakeholders, and to explain my own research. A list of presentations made by me at these and other events can be found in Appendix 4.

4.2.5 Participation in GBIF Hunting Records Project

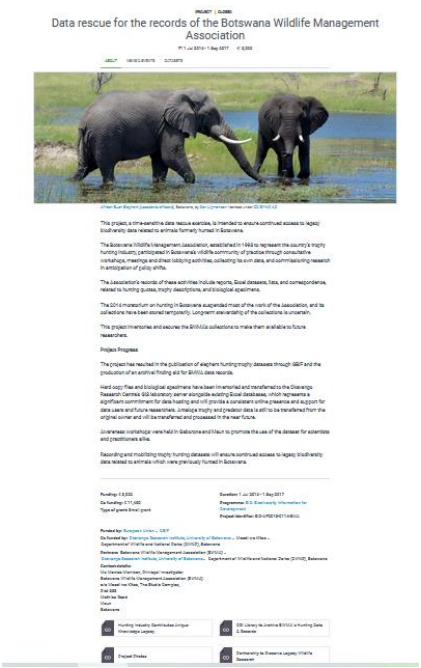


Figure 4-3 GBIF project page (click on image for link to web site)

Early in the research for this study, I realised that, as a humanities scholar, my limited knowledge of the processes of generating and using wildlife data was a barrier to understanding the concerns and

practices of researchers and potential users of research carried out in northern Botswana. In 2016, an opportunity to learn more in a practical setting was presented in the form of a call by the Global Biodiversity Information Facility (GBIF) for proposals to carry out biodiversity data management projects in Africa. I had been following the Government of Botswana's moratorium on hunting through discussions with the Secretary of the Botswana Wildlife Management Association (BWMA), a formal group of commercial hunters. Realising that the records and trophy data collected by the association were at risk of disappearing on dissolution of the association, I wrote a project proposal for a joint effort by the association, the University of Botswana Okavango Research Institute, and the Botswana Department of Wildlife and National Parks to preserve the materials and publish the datasets on the GBIF platform. When the project was awarded, as principal investigator, I was able to participate in the process of data transfer and processing, and to observe interactions among participants from the three institutions. Discussions of the utility of the data at two stakeholder awareness workshops in 2017 helped to provide context to my research, and more understanding of the challenges of data interoperability and use.

4.3 Primary data collection and analysis

Having discussed the exploratory context phase of my study, I will now focus on the three key study components of my doctoral research, and the data collection for each of these.

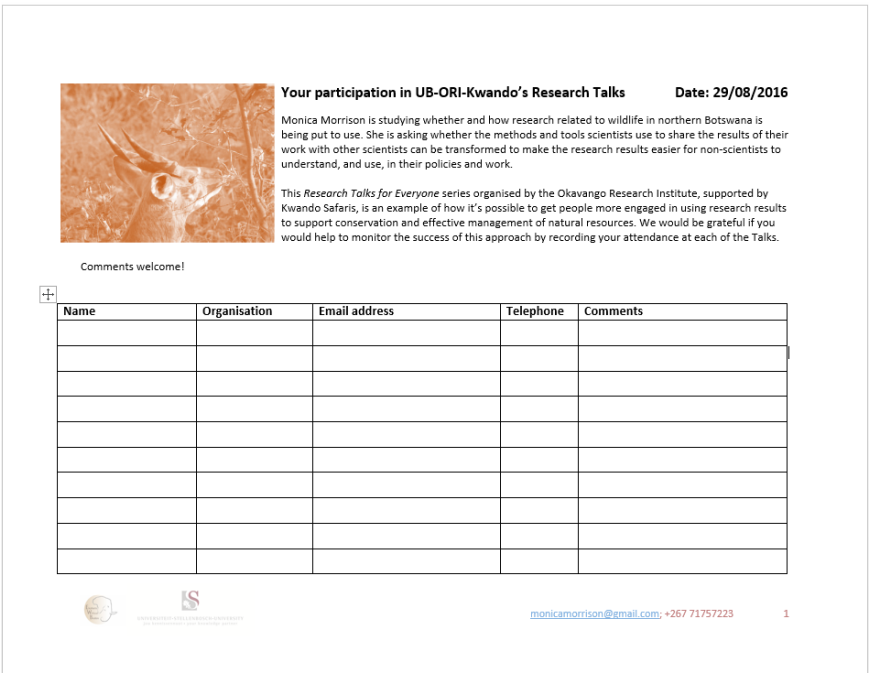
This phase consisted of two surveys with associated interviews, and collection and examination of the content of two sets of research outputs from northern Botswana research.

4.3.1 Case study of Research Talks for Everyone

The month following the first *Do…Follow!* Meetup, Dr Emily Bennitt, a zoologist and research scholar at Botswana's Okavango Research Institute, and the manager of Kwando Safaris initiated a series of talks intended to inform the local community about research being carried out in the Okavango region. The organisers agreed that I could participate as an observer, making a record of who participated as presenters and audience members. The origin and nature of the event, *Research Talks for Everyone*, are discussed in more detail in Section 6.2, Chapter 6.

A study of the event was carried out over a two-year period, to see if the event itself could be considered a productive interaction, whether it created opportunities for ongoing productive interactions, and whether it resulted in uptake of the research presented.

The work was carried out in three parts: collection of attendance data, an online survey of attendees, and follow-up interviews with selected respondents.



Your participation in UB-ORI-Kwando's Research Talks **Date: 29/08/2016**

Monica Morrison is studying whether and how research related to wildlife in northern Botswana is being put to use. She is asking whether the methods and tools scientists use to share the results of their work with other scientists can be transformed to make the research results easier for non-scientists to understand, and use, in their policies and work.

This *Research Talks for Everyone* series organised by the Okavango Research Institute, supported by Kwando Safaris, is an example of how it's possible to get people more engaged in using research results to support conservation and effective management of natural resources. We would be grateful if you would help to monitor the success of this approach by recording your attendance at each of the Talks.

Comments welcome!

Name	Organisation	Email address	Telephone	Comments

monicamorrison@gmail.com; +267 71757223 1

Figure 4-4 Research Talks attendance sheet

Patterns of attendance at the *Research Talks for Everyone* event were observed in person and recorded, over a two-year period from October 2015 to October 2017. The attendance sheet (see Figure 4-4) circulated at each event recorded names, email addresses, telephone numbers, and comments, and the data collection and observation process was announced at the beginning of each event. Data captured on the sheet were entered into Excel workbooks that were then shared with the organisers so they could update their email distribution list. Data from the attendance sheets were used to understand the composition of the stakeholders attending in terms of organisational affiliation, gender, and role in relation to the event.

To investigate interactions and possible uptake of the research shared at the event, an online survey consisting of 20 questions was compiled (Appendix 2). After establishing stakeholder roles, key questions aimed at determining interactions among the participants, and any evidence of learning and uptake as a result of the event. The survey structure was designed to elicit the following:

- Affiliation
- Interactions related to awareness of the event
- Any changes in motivation for attendance
- Role in the event
- Any changes in frequency of attendance
- Interactions with presenters
- Conceptual, instrumental and strategic uptake of learning from the event.

In April 2018, the online survey was distributed via SurveyMonkey to 138 recipients who, according to the attendance list, had attended the Research Talks more than once. Sixty-six people responded to the survey, of which nine people had left almost all questions unanswered. Fifty-seven valid responses were therefore received, which gives a response rate of 41%.

Data from the survey were analysed using SPSS. Statistics Version 26. Bonferroni tests for comparison of proportions were used to establish statistical significance, when two categorical variables were cross-tabulated, specifically, to determine which categories of the one categorical variable displayed significantly different proportions of the other variable.

There were 21 positive responses to the last question in the survey that asked if the respondents were willing to participate in a follow-up interview. Following analysis of the survey data, follow-up in-person interviews and email exchanges were held with 14 of these survey respondents to obtain more details about their responses. These 14, chosen for their representation of different stakeholder groups and their availability (five of those agreeing to follow-up interviews had left the country), were researchers from academic institutions (2), consultants (1), NGO employees (3), and private sector tourism and services (8). Two of these were e-mail exchanges as the respondents could not meet in person. Eleven in-person and one Skype interviews were recorded and transcribed.

Follow-up interview questions addressed specific individual responses of the interviewees to the survey questions (Appendix 2), focusing on their reports of interactions with presenters, and influence of what they had learned at the Talks on their thinking, their work, and on their interactions with community members.

Analysis of the survey results and findings of my study of the event are described as part of the case study report in Chapter 6.

4.3.2 Case study of Botswana research permit holders

The case study discussed in this section analysed work carried out under the research permit system administered by the Government of Botswana's Ministry of Environment, Natural Resources, Conservation and Tourism (MENT) through the Department of Wildlife and National Parks (DWNP). This section provides necessary context for the case study, and describes the methods used to support this analysis: through a follow-up survey and interviews associated with a set of Botswana research permits issued between 1996 and 2014.

4.3.2.1 Government of Botswana research regulation

As explained in more detail in Chapter 2, since production of its first national wildlife research strategic plan in 1993, and subsequent versions in 2004 and 2016, Botswana's Department of Wildlife and National Parks (DWNP) has included privately sponsored wildlife studies in its policies to contribute to the country's knowledge base and supplement the work of the department's own researchers (Botswana Dept. of Wildlife and National Parks, 2004, 2016).

The government's system of research permits delegates their administration to line ministries, which in turn, assigns this work to relevant departments. The parent ministry for the DWNP is the Ministry of Environment, Natural Resources, Conservation and Tourism (MENT). Permits stipulate that principal investigators regularly report their progress to the relevant department, with copies sent to appropriate regional representatives; usually those who are closest to the research location, and that final outputs are shared with Government of Botswana.

4.3.2.2 The dataset

The original source of data for this study was a list of research permits issued between 1996 and 2014, provided in the form of an Excel spreadsheet by the national coordinator for research at MENT in 2014. These were permits that had been assigned for administration by DWNP, as opposed to other MENT departments such as Environmental Affairs, Waste Management and Museums, and so are often referred to as DWNP permits. During the period 1996 to 2014, 256 unique permits were issued from the Botswana Ministry of Environment, Wildlife and Tourism as the responsibility of the DWNP. Of these, 11 were issued for commercial filming, or for an event, rather than for research, so these were eliminated from my investigation. The remaining 245 were issued to 226 individual Principal Investigators (PIs): some PIs were issued more than one permit during the period.

The DWNP list included names of the PI and other researchers and support staff on the project, home and email addresses of the PI at the time of the work, project name and reference number, project location, and permit start and end dates.

The first step of this investigation was to obtain current contact information for the 226 PIs through direct contact, email and telephone. I was able to obtain last known addresses for 211 of the 226 PIs. Five researchers were deceased, but I was able to contact a co-researcher for one of these, leaving 207. Thirteen of these responded to say that, although they had received a permit, they had not carried out the planned research. The reasons given for this were:

- Graduate student passed away (1)
- PI had family problems and did not complete graduate studies (1)
- Project or PI did not receive anticipated funding (6)
- PI dropped out of project (1)
- Anticipated study subjects were not available, so PI carried out research elsewhere (2)
- PI found employment (2).

In addition to the PIs considered relevant to this study, the names of 339 additional researchers or research support personnel were included on the permits. Of these, 285 were unique, i.e. perhaps had participated in more than one project under permit. Although the focus of this survey was on principal investigators, team members are mentioned here because the analysis of student thesis writers in Chapter 7 is based on the work of some of these researchers.

Identifying data for the remaining 194 principal investigators were cleaned by correcting spelling and completeness of names, and new tables created that further separated the data presented in the original spreadsheet.

4.3.2.3 The survey

An online survey, using SurveyMonkey, was distributed to 194 PIs whose current addresses had been verified from the original list. Of these, 10 (5%) declined to participate in the investigation, and 55 (28%) did not respond to follow-up reminders.

In 40 questions, most of which allowed for multiple choices and open-ended responses, the survey asked researchers about the interactions they had with the following categories of wildlife stakeholder when they were in the field, to focus on interactions that took place during the period covered by the research permit and that might have been influenced by the permit conditions.

- DWNP or other Botswana government officials
- Local communities
- Other researchers permanently based in Botswana
- Other researchers not permanently based in Botswana
- Botswana-based NGOs.

The survey questions took the following structure, based on the stages of a research project:

- Your Botswana research (description of the research topic, geographic extent, professional status, discipline)
- Planning of your research (choice of research topic and location)
- Fieldwork (reporting and description of interactions with five categories of stakeholder, including assistance received in the field, and reporting and feedback for DWNP)
- Sharing and use of raw data (bidirectional data sharing and re-use)
- Sharing and use of analysed results (use of government documents, acknowledgements, recipients and methods of sharing results)
- Use of research (perceptions of use of research results, relevance).

There were 131 complete responses to the survey, three of which were eliminated because of duplication, leaving 128 completed responses (66%) that were included in the study.

Upon completion of the survey, some external data and categorisation were added to allow for further analysis. This included determining through direct inquiry the nationality of the PI, and whether or not they were still working in Botswana[20].

Knowing the nationality of the PI spoke to the concern expressed by stakeholders that foreigners dominate wildlife research **(RT001, RT005).** This could be explained by the high proportion of principal investigators who are foreign students, combined with the practice of local principal investigators including foreign graduate students on their teams. Of the 256 permits, however, 71 (28%) of the permits had been issued to Botswana citizens, some of whom were studying abroad, and 23 (10%) were issued to longer-term Botswana residents. Figure 4-5 illustrates the nationality of research permit holders other than Botswana citizens.

[20] Obtaining this information was possible through inquiring in Botswana's small and close-knit wildlife research community of practice networks.

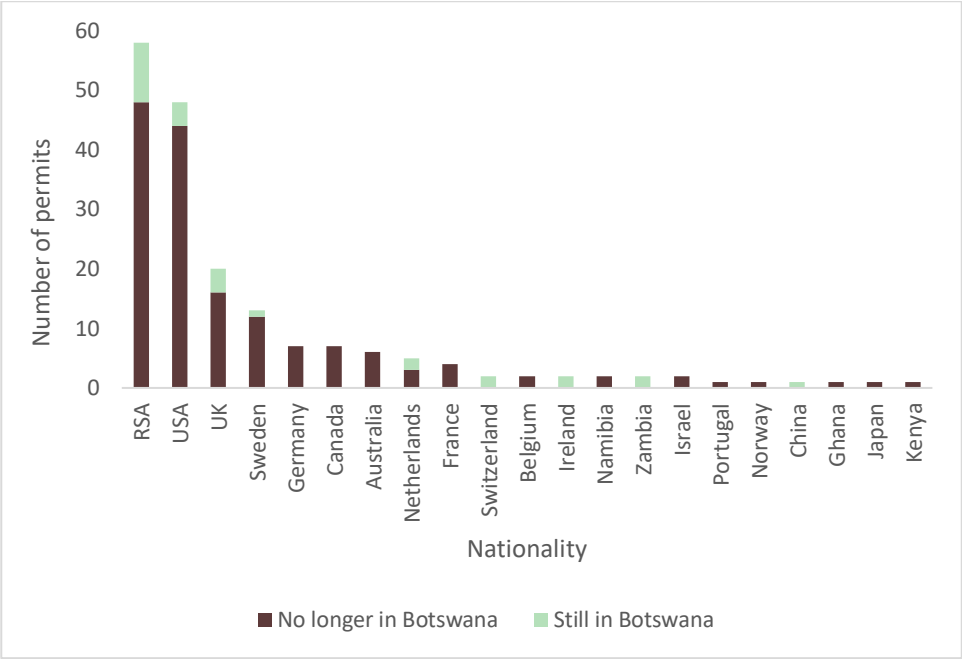


Figure 4-5 Nationality of PIs issued permits and whether they were still working in Botswana at the time of survey (n=185)

At least 30% of team members on the studied permits were Botswana citizens. It needs to be noted, also, that during the period studied, researchers from Botswana institutions often did not apply for research permits as it was understood that their institutions had 'blanket' permission for studies in the country[21]. Research commissioned by, or in partnership with, the Botswana government also often did not involve issuing of a research permit: one example is the body of studies carried out under the BONIC Project of the Norwegian Institute for Nature Research in the Chobe area (Skarpe, 2002).

These data indicate that Botswana citizens were not only engaged in wildlife-related research, but that foreign research permit holders had opportunity for interactions with Botswana researchers – and with that, networking opportunities with other stakeholders based in Botswana – throughout the research process. Both these conditions allowed for early engagement of local stakeholders in priority setting and planning. Nationality data was later used to support the analysis of bibliographic citations in Chapter 7.

The length of stay in Botswana was important because there are indications that long-term commitment to a region of study can affect uptake of the research. Botswana's research permit process allows for extensions if reporting requirements and adherence to regulations are observed. Sometimes a single permit is extended many times, retaining the same reference identifier, and other times a researcher may obtain a series of different permits, working as either principal

[21] Mosepele, K. Personal communication, 2015

investigator or as part of a team. Looking at all research permit holders included in this study, the length of research period for permits ranged from a few days to 13 years, with an average length of 27 months. During the period studied, one researcher worked a total of 484 months as either a principal investigator or team member on 11 different permits.

These externally sourced data were added to Excel spreadsheets. Also, semi-controlled vocabulary (literary warrant approach[22]) category tags were also added to open ended responses and comments for 26 questions in SurveyMonkey, and exported to an Excel spreadsheet. Figure 4-6 shows an example.

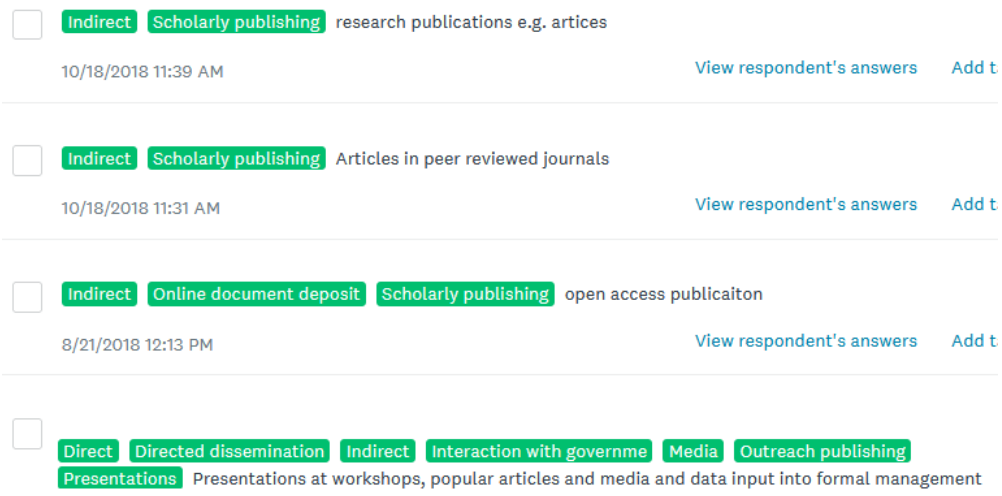


Figure 4-6 Sample of tags added to survey responses

The raw survey data for responses were exported to SPSS Version 25. The category tags in SurveyMonkey could not exported with the raw data and had to be added to the SPSS data in a separate step via Excel.

Statistical significance testing was performed in SPSS, by using the Bonferroni test for comparison of proportions. The test was applied when cross-tabulating two categorical variables, to determine which categories of the one variable have significantly different proportions of the other variable.

4.3.2.4 Interviews

In addition to 24 semi-structured interviews carried out in the first phase of the research, and 14 conducted as follow-up to the Research Talks survey, 48 direct one-on-one and group interviews were carried out in person or through telecommunications (Skype, email and telephone) to add context to survey and bibliographic findings. These included 15 from the private sector, 10 with research consultants, nine with government officials, eight with academic researchers working in

[22] Classes and names of classes derived from existing literature rather than a preconceived philosophical order of sciences.

academia, and six with NGO representatives. Face-to-face and Skype interviews were recorded, and transcripts prepared. Table 4-2 provides a list of all documented interviews with the codes used to identify them in the text of this thesis.

Interview records were anonymised for the purpose of quoting respondents in this thesis using the codes in the first column of this table.

Table 4-2 List of interviews

Code	Role	Category
E001	Professional Researcher	Consultant
E002	Manager	Consultant
E003	Student	Academic Researcher
E004	Student	Academic Researcher
E005	Student	Academic Researcher
E006	Manager	Government official
E007	Professional Researcher	Academic researcher
E008	Manager	NGO
E009	Manager	NGO
E010	Manager	Private sector
E011	Manager	Government official
E012	Manager	Private sector
E013	Student	Academic researcher
E014	Manager	Private sector
E015	Professional Researcher	Academic Researcher
E016	Manager	Consultant
E017	Manager	Academic researcher
E018	Manager	Government official
E019	Student	Academic researcher
E020	Manager	Private sector
E021	Guide	Private sector
E022	Manager	Government official
E023	Manager	Academic staff
E024	Manager	Private sector
E025	Guide	Private sector
E026	Manager	Government official
G001	Manager	Academic staff
G002	Manager	Government official
G003	Manager	Private sector
G004	Manager	Private sector
G005	Professional Researcher	Consultant
G006	Manager	Private sector
G007	Professional Researcher	NGO
G008	Professional Researcher	Academic researcher
G009	Professional Researcher	Academic researcher
G010	Manager	Government official

Code	Role	Category
G011	Professional Researcher	NGO
G012	Professional Researcher	Consultant
G013	Manager	Government official
G014	Manager	Private sector
G015	Professional Researcher	Consultant
G016	Professional Researcher	NGO
G017	Manager	Private sector
G018	Professional Researcher	Consultant
G019	Manager	NGO
G020	Professional Researcher	Academic researcher
G021	Professional Researcher	Academic researcher
G022	Professional Researcher	NGO
G023	Professional Researcher	Government official
G024	Professional Researcher	Government official
G025	Professional Researcher	Government official
G026	Professional Researcher	Government official
G027	Professional Researcher	Government official
G028	Manager	Government official
G029	Manager	Consultant
G030	Professional Researcher	Academic researcher
G031	Professional Researcher	Consultant
M001	Manager	Consultant
M001	Professional Researcher	Academic researcher
M002	Guide	Private sector
M003	Manager	Private sector
M004	Manager	Private sector
M005	Professional Researcher	Private sector
M006	Guide Trainer	Private sector
M007	Manager	Private sector
M008	Manager	Consultant
M009	Guide Trainer	Private sector
M010	Guide Trainer	Private sector
M011	Manager	Private sector
M012	Manager	Private sector
RP001	Professional Researcher	Consultant
RP002	Professional Researcher	Academic researcher
RP003	Student	Consultant
RP004	Professional Researcher	NGO
RT001	Professional Researcher	Academic Researcher
RT002	Manager	Private sector
RT003	Manager	Private sector
RT004	Manager	Private sector
RT005	Professional Researcher	NGO
RT006	Manager	Private sector
RT007	Manager	Private sector

Code	Role	Category
RT008	Guide	Private sector
RT009	Professional Researcher	NGO
RT010	Manager	Private sector
RT011	Manager	NGO
RT012	Professional Researcher	Consultant
RT013	Student	Academic researcher
RT014	Manager	Private sector

Semi-structured interview guides had been prepared for government officials, academic researchers, NGOs, and the private sector, covering in detail types and mechanisms of interactions, and perceptions of uptake and use. Use of these guides, however, proved to be challenging, mainly because of the relatively small size of the community of practice, long-term nature of the fieldwork, and previous engagements with many of the stakeholders through exploratory discussions, workshops, meetings, the *Do…Follow* Meetup, and *Research Talks for Everyone*. Long-term research in a limited geographic and social environment can result in informant fatigue.

For interviews, I found a largely unstructured approach with occasional probes a more useful technique, explaining the evolution of my approach to what I was studying, and then following the lead of the interviewee in their assessment of the approach, e.g. (an invented, but indicative, example):

> *Interviewer: I am trying to understand whether and how all the research that gets carried out about Botswana wildlife gets into use.*
>
> *Interviewee: Oh that is really important.*
>
> *Interviewer: Why do you say that?*
>
> *Interviewee: So much gets wasted. You know that most of those studies are gathering dust on government shelves.*

The disadvantage of unstructured interviews is that, while they provide rich context, they are more difficult to analyse to discover quantitative patterns. Following transcription, the content of interviews was read and compared in the context of the more structured survey findings. Excerpts from the interviews are used throughout this thesis to support observations and findings.

A sample of the in-depth interview framework guides is included in Appendix 6 as it may prove to be of future use.

Arranging formal interviews with senior government officials was challenging, partly because of the physical distance (1000 km) between Maun and Gaborone, and the expense of visiting the capital for long enough to ensure sit-down exchanges with busy managers – scheduled meetings are often postponed. Exchanges with headquarters-based officials were mostly opportunistic: it was

sometimes possible to meet when they travelled to Maun on official business. Attempts to engage government officials in telephone or Skype interviews were often unsuccessful, partly because of busy schedules, but perhaps also because there seems to be a tendency to avoid 'going on the record' about government operations, especially in relation to what are viewed as sensitive wildlife management issues. Even contacting DWNP officials in Maun could be a challenge as the research team was frequently away in the field. I found that the best source of government thinking on the topics I was following came from formally organised meetings and workshops, where an agenda safelyframed discussions. But because iterative engagement with DWNP officials, as principal wildlife stewards, was so important, two group interview sessions were carried out with Maun-based DWNP regional wildlife research unit members in May 2019 in the form of a brief presentation of interim findings of my work, followed by responses and discussion captured in notes and forms based on a simplified version of the interview guide. The outcome of these particular sessions largely confirmed what had been learned through other channels.

4.3.3. Using research outputs of permits to explore interactions and uptake

The outputs generated under the research permits were analysed in two studies that explored possible proxies for, on the one hand, productive interactions and, on the other hand, research uptake through capacity building. From the beginning of the research permits study, frequent searches of bibliographic sources to identify and collect outputs from the work carried out under the original 256 permits were carried out. This included the databases of library catalogues, university repositories, Google Scholar, Web of Science, JSTOR, ResearchGate, Academia.edu and other online resources. The names of PIs and team members, and words from the project description in the original DWNP spreadsheet, were used in these searches. The research permit survey requested that respondents send lists of publications that resulted from their work under permit. Any of these received and outputs from lists of publications shared with me by local researchers were added. The year of the first permit in the DWNP research permit dataset, 1996, was used as the starting point for capturing outputs, and collection continued until 2019, when the database included 1138 unique items. The 1138 items were associated with 200 of the 256 permits.

Bibliographic metadata for items found were included in a Mendeley database, customised to include an *Owner* field, which is a database field for the unique number associated with each record (in this case, research permit numbers). *Document Type* was also included as a database field. The latter comprised six categories:

- Article (papers in journals, book reviews)
- Book
- Book Section (chapters)

- Conference Paper (including posters)
- Report (any monograph that is not a book, e.g. working paper, submission to Convention meeting, technical report, manual
- Thesis.

Using JABREF software, the records from the Mendeley database were exported to produce a CSV file that included the *Owner* (unique number for each permit) and *Document Type* fields. The CSV file was then merged with an Excel spreadsheet that contained a small set of relevant data from the research permit survey, matching the records through the unique research permit number. Relevant survey data were the category of PI (professional researcher or student researcher) and the entities that the respondents had acknowledged when writing up the results of their research. The survey provided the respondents with seven options to do so and they could name more entities in an open-ended response. Once merged in Excel, the dataset was imported into a Microsoft Access database for analysis. A subset was also taken to SPSS for purpose of significance testing.

These data records were then used to carry out the text and bibliographic analyses described in Chapter 7, to explore their possible use as proxies for productive interactions and research uptake through capacity building. The study of suitable proxies for productive interactions involved an analysis of the written acknowledgements of student theses produced by the research permits. The study of research uptake through capacity building, on the other hand, focused on the number and category of thesis outputs produced by the research permits (so-called 'direct capacity building outcomes'). The latter study went a step further by also systematically analysing the citing of research permit outputs in theses and dissertations globally (so-called 'indirect capacity building outcomes'). The methods of the two studies are discussed next.

4.3.3.1 Acknowledgement texts

Interactions between researchers and stakeholders who might use their research are sometimes documented in the written acknowledgements researchers provide in their published work. To explore whether this was visible in outputs from the Botswana research permits studied, the text of acknowledgements of theses written by students who worked under these permits was analysed.

Of the 1138 outputs identified by 2019, 159 were theses or dissertations, produced by 110 permits. For 111 of these theses, it was possible to obtain the full text from online repositories, or by request from the author. To obtain full texts online, the names of all researchers listed under the relevant studied permits, including the PIs (520 unique individual researchers), were searched using the Web of Science, Google Scholar, web resources for theses and dissertations (OATD, EThOS, WorldCat), university library repositories, and faculty and student web pages. The full text of some theses was not available online, even though availability was checked over a five-year period (2014-2019). For

the 111 theses with a full text version online, the acknowledgments section of each was extracted and saved in a Microsoft Word document.

The content of each text was then coded through reading the text and manually assigning descriptors. The text content of the extracts was analysed for two types of information: what kind of entity was thanked, and for what. A pair of terms was captured just once for each acknowledgement text: if, for example, five NGOs were thanked for providing funding, one entry was created for the pairing of entity acknowledged with the type of support supplied. A list of descriptors was developed to represent both categories and aligned with the categories produced from the responses to the survey question that asked about acknowledgments. The descriptors used in the coding are included in Chapter 7.

The codes were added to the dataset of research outputs in an Excel spreadsheet, whereafter part of the data were imported into SPSS Version 25 for analysis.

4.3.3.2 Bibliographic citation analysis for capacity building study

A possible outcome of research is its uptake through learning by new researchers as they pass through the academic degree-granting system. To investigate whether research outputs (such as theses, journal articles, books, conference proceedings, and web-based material) created under the studied Botswana research permits were used to help in building capacity of other researchers, a search of all citations of the original 1138 Botswana outputs was made through Google Scholar. Google Scholar was selected for this purpose because the resource captures a broader range of materials, including some 'grey literature'[23] (Haddaway & Bayliss, 2015).

An automated script was written for a web crawler to extract the citation data from the Google Scholar web site. The input file for the crawler was the list of titles and authors of each of the 1138 permit outputs. Figure 4-7 illustrates the process of selection of records for the following analysis.

[23] Grey literature refers to documents that are produced outside the usual academic and commercial publishing systems.

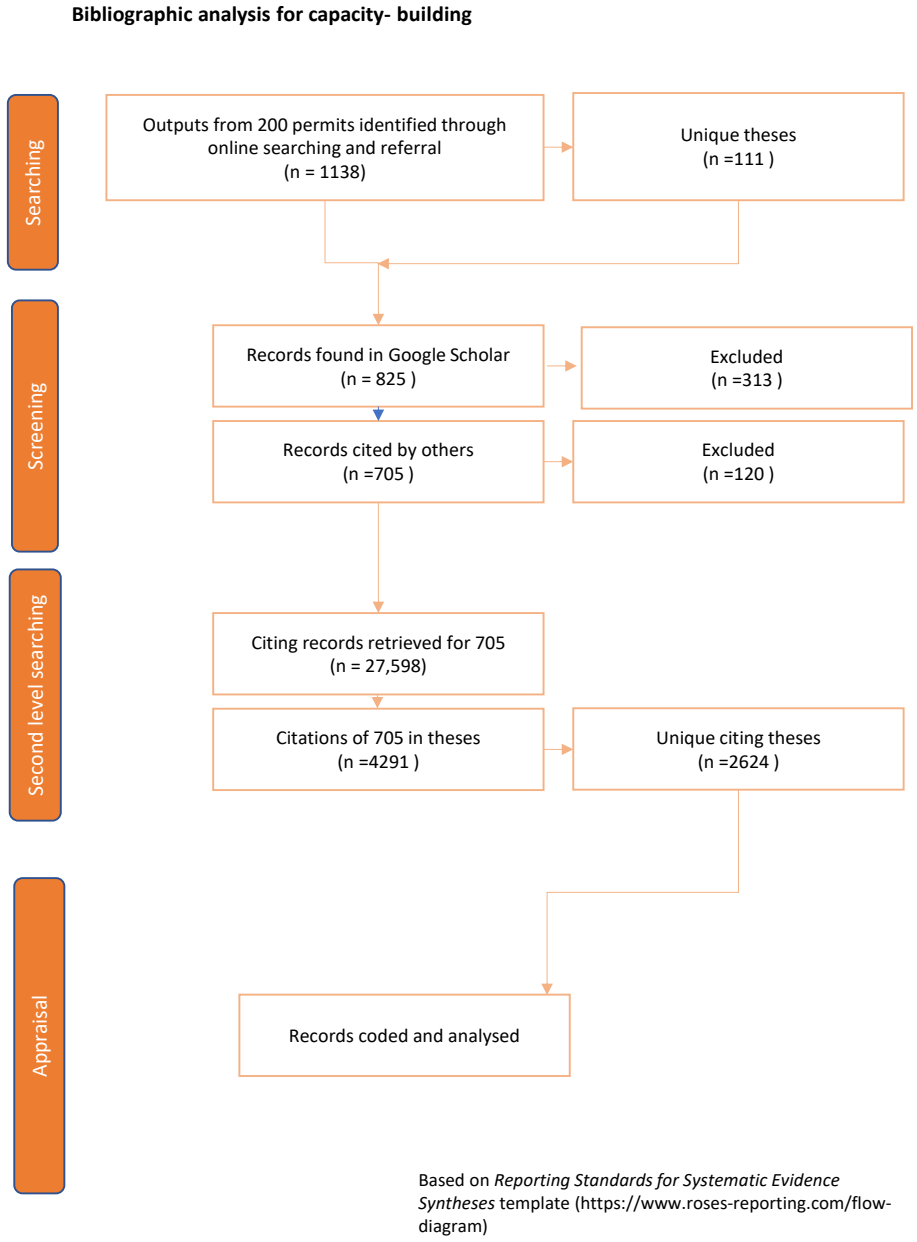


Figure 4-7 Bibliographic analysis process for capacity-building study

The resulting dataset of 27,598 records was saved as a Microsoft Access database. The reason for using Microsoft Access was that it is a relational database system. In other words, it could link the table of citation data to a separate table of source data based on unique identification numbers.

From the information in the citation dataset, it was not immediately clear which of the 27,598 citing records were theses or dissertations. The document type of each record in the citation dataset therefore first had to be determined. To some extent, identification of theses and dissertations was facilitated by searching the 'publisher' and 'URL' fields in the citation dataset with the following terms: *etd*, *repositor**, *tesis*, *theses*, *thesis* and *dissertation**. A search in the same fields – for the terms *article*, *journal*, *revista*, *bulletin*, *boletim*, etc. – also assisted with rapid identification of articles.

Eventually, 2624 unique theses were identified in the citation dataset. These, as well as the 111 unique theses in the source dataset, were subsequently categorised by:[24]

- Level (Bachelors, Masters, PhD)
- Country of the institution issuing the degree
- Countries or regions of the study names of countries or regions where fieldwork or zoo study took place or that were the focus of the study (International, or Unspecified if laboratory, literature or model-based).

This coding process for theses involved several steps, depending on availability of the needed information:

- Going to the URL link provided by Google Scholar in the citation dataset, to open the Google Scholar record online.
- Checking if the Google Scholar record had sufficient information.
- If needed, using the document link for the Google Scholar record online, to view description of the document record, often in a repository or on a journal website.
- If still needed, viewing the document full text (usually in PDF) to provide the information for coding.

When the data provided in the citation dataset did not include a working URL, a text search of the title, first in Google Scholar, and then in Google, was carried out to find the document. University repositories were usually good sources of the needed information, depending on their use of Dublin Core[25] metadata to indicate level of degree and institution. Most repositories provided a link to the full text. ResearchGate frequently provided results while Academia.edu provided poorer quality

[24] A column for 'broad discipline' (natural or social sciences) was initially included, but not used, as it proved difficult to determine a clear method for categorisation.

[25] The Dublin Core™ metadata standard is an element set for describing a wide range of networked resources. It is frequently used in open-access document repositories to indicate authorship, organisational affiliations, and document type. (Hillman, 2005)

information. Links to Academia.edu from the Google Scholar search mostly did not work. In a few cases (3%), the data provided was not sufficient to identify or retrieve the citing source.

In most cases it was necessary to open the full text of theses to establish the geographic focus of the work. This was discovered through searching the text for the term *study site*, or reviewing the content for mentions of locations. If multiple countries transcending regions were studied, the term *International* was used. If the work was carried out in zoos or laboratories, the name of the country where these institutions were located was entered. If it was not possible to establish a location, *Undetermined* was entered.

These data were processed through database searches in Microsoft Access to produce the analysis described in Chapter 7.

Finally, the *Filled Maps* charts feature in Microsoft Excel Version 2008 was used to visualise the global disseminated influence of the original research permit outputs.

4.4 Limitations of the methodology

This research was characterised by an organic development of participant observation that moved towards action research[26], an approach that did not lend itself easily to structure and planning. This approach was enabled in my case by my longer-term presence in 'the field' than is usual for most graduate students. Exploratory, opportunistic, and ethnographic, it was an iterative process that required constant adaptation, and perhaps led the researcher down investigative paths that could not provide immediate results. The approach did, however, enable understanding of the nature of human interactions at the core of the study.

Use of a survey approach inevitably runs the risk of inaccuracy, as respondents report subjectively, depending on memory, and affected by cognitive bias. In some cases, respondents were asked to reconstruct activities that took place more than 20 years previously. While one could argue that what was remembered after so long must have been significant, it is possible that this contributed further to bias.

The study population was small in all cases, naturally limited by the location and extent of the work being carried out in northern Botswana. While this made the work of the investigator easier on the ground, it also made statistical analysis frustrating.

26 Action research is a systematic approach to investigation that seeks to engage the complex dynamics involved in any social context, using continuing cycles of investigation to reveal effective solutions to issues and problems experienced in specific situations and localised settings (Stringer, 2013). The literature of research uptake in the context of conservation science contains many recommendations for the use of action research, which, because of its iterative nature, reflects the adaptive management approach used in conservation science, and because it offers to help link the worlds of research, policy, and practice.

There is little information about people who did not participate in the surveys: it is possible that there are non-response biases.

All of these, however, point to an interesting path to further investigation.

4.5 Ethics

Ethics review for work carried out under the IDRC research grant in 2014 was provided by the IDRC's Advisory Committee on Research Ethics, following completion of the course, the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE). Ethical clearance for the two surveys and follow-up interviews was applied for in 2017 and received from Stellenbosch University in February 2018. See Appendix 6.

The ethical challenges of carrying out fieldwork in a small and closely-knit community in which some issues related to wildlife were controversial did not feel unsurmountable. Sensitivities and disagreements in this community of practice are often publicly expressed and I was never questioned about the potential sharing and use of the data I was gathering. Nevertheless, names of informants and organisations were mostly withheld, and, in some cases, I chose not to quote informants. I did occasionally change information, such as pronouns that indicated gender, that might lead the local reader to identify specific people.

4.6 Summary

This chapter described the steps followed in the mixed methods approach. The first phase of the research explored the context of wildlife research in northern Botswana through local literature and initial interviews. The second phase focused on data collection in the form of two surveys, assembly of bibliographic references, follow-up interviews, and analysis of the data collected. The results of the work of the second phase are presented in Chapters 5, 6 and 7.

A mixed methods approach brings challenges in the form of systematically integrating quantitative and qualitative data. I think that the iterative process that allowed analysis of literature, interviews and survey responses to feed and build on the data collected provided valuable context, and greater depth and breadth of information than I possibly could have obtained by using a single approach in isolation. Qualitative and quantitative methods were used concurrently rather than sequentially, which allowed for this feedback loop. It is recognised that this approach is costly and time-consuming, and requires learning how to apply a range of methods, but perhaps this supports the argument made elsewhere in this thesis for longer-term research engagement with a location and topic.

Next presented, in Chapter 5, are the findings of the study of the work of Government of Botswana research permit holders who were carrying out research in northern Botswana between 1996 and 2014.

Chapter 5 Case study of Botswana wildlife research permit work

Wildlife conservation research, carried out as applied science, is intended to result in an outcome: effective management of a resource that contributes to both a country's economic and social development, and to healthy ecosystems. Data produced by wildlife research should contribute to new knowledge that results in continuous improvement of wildlife management processes, but the strategic sharing of data and insights needed to achieve this often does not take place. Lack of awareness, access, relevance, legitimacy, trust, and understanding, are factors discussed in Chapter 3 as limiting the sharing of research data and contributing to poor uptake and application of research.

Can the regulatory process of issuing permits for research lead to productive interactions through building these qualities? This chapter looks at how the use of data and findings produced by wildlife conservation research in Botswana is affected by a regulatory process: the national government's research permit system as applied to the stages of the research 'pipeline' from project identification through to publication of results.

5.1 Introduction

An online survey of principal investigators who were issued research permits by the Botswana Ministry of Environment, Natural Resources and Conservation through the Department of Wildlife and National Parks between 1996 and 2014 was carried out to investigate whether productive interactions had taken place through the research process. The survey set out to determine if interactions between the permit holders and other Botswana wildlife stakeholders could be seen to contribute to the use in policy or practice of the research produced, leading to understanding of which types of interactions could be considered most productive. For this purpose, *interactions* were considered to be either direct (in-person) or indirect (through documents or other communications materials), and *use* – sometime referred to in this thesis as contribution outcome -- to include any application of knowledge on a continuum from acknowledgement to instrumental application in regulation or management planning.

Because many of the responses were based on elicited perceptions and memories of the permit holders of work that took place up to 20 years previously, published outputs that were a result of the specific work done under permit were also reviewed to provide another indication of research outcomes: this is discussed specifically in Chapter 7. To provide context for the findings of the survey, reference is made to interviews carried out with researchers and research stakeholders living and working in northern Botswana during the period studied.

Analysis of the survey results focused on several engagement functions that research uptake scholarship has shown to contribute to the creation and sharing of new knowledge, its recognition, and application:

- Joint priority setting and project planning to ensure the relevance of the work to management (Dudley et al., 2018; Neff, 2011; Sutherland et al., 2012)
- Ongoing knowledge exchange to build trusted relationships (Cvitanovic et al., 2016; Goggin et al., 2019; Reed et al., 2014)
- Sharing the knowledge base as it grows, and building capacity across stakeholder groups (Evely, Pinard, Reed, & Fazey, 2011; Rodríguez-Izquierdo, Gavin, & Macedo-Bravo, 2010; Sobratee & Slotow, 2019)
- Commitment to long-term engagement (Gingrich et al., 2016; Janzen, 2009; Pusey, Pintea, Wilson, Kamenya, & Goodall, 2007).

Of particular interest is the possibility that the regulatory research permit process itself could facilitate these functions, resulting in more useable research for the management of wildlife and wilderness in Botswana.

The results of the survey, supported by related interviews, are presented in this chapter. Section 5.2 of this chapter describes the professional status and disciplinary background of the principal investigators who took part in the survey, as well as their motivation and geographic areas of study. Section 5.3 examines the perceptions of respondents as to whether and how the research they carried out under a permit had been put to use. Section 5.4 describes the relationship between participant characteristics and their perception of use of their research. Section 5.5 examines the research–stakeholder interactions reported, and their relationship to perceptions of use. Section 5.6 looks at the respondents' perception of the relevance of their research and its relationship to perceptions of use, followed by concluding comments in section 5.7.

5.2 Profile of survey participants: the principal investigators and their work

The principal investigators who held the research permits studied represented a mix of backgrounds, disciplines, and professional affiliations. The survey sought to discover if any of these characteristics were related to interactions that were likely to lead to uptake of the research carried out under the permits.

5.2.1 Professional status at the time of the research

It is possible that the professional status of researchers – career stage and institutional role – might affect the societal relevance of their research, and the interactions that could lead to uptake of their findings. Respondents were asked to report their professional status at the time they received their research permit. Figure 5-1 shows their responses.

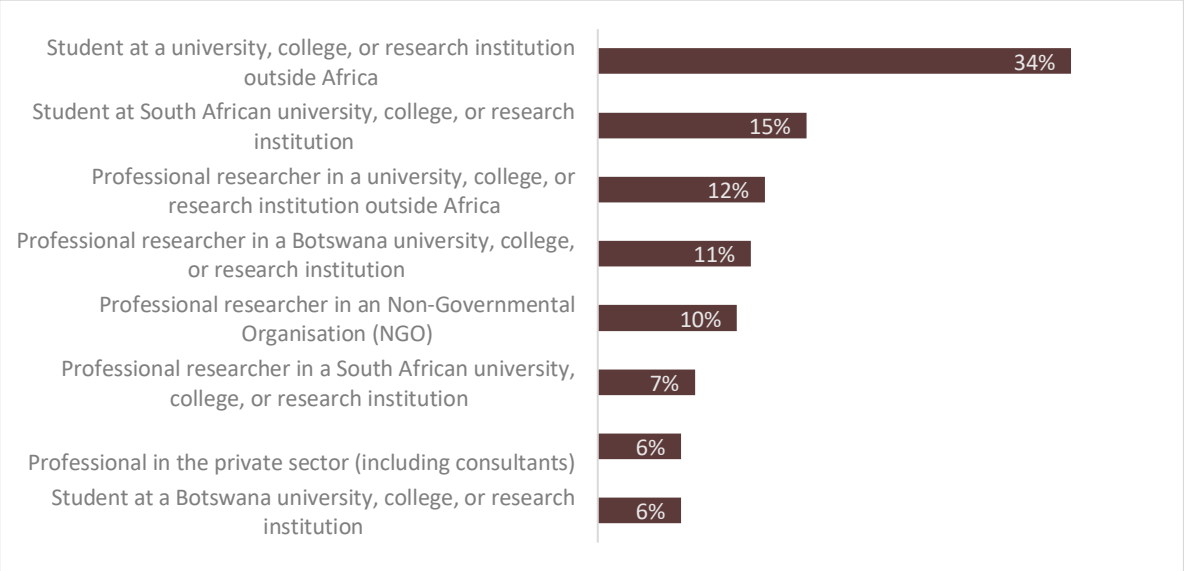


Figure 5-1 Professional status at time of research (n=128)

The larger share (about a third, 34%) of PIs were international students outside the African region. If South African students are added to this, then almost half of the respondents (49%) were international students.

5.2.2 Current areas of study

Identifying the fields of study of the principal investigators surveyed can help to indicate the areas of anticipated influence and use of the research produced. Data from the survey covered a period of almost 20 years, during which time, at a global level, scientific disciplines related to nature conservation both multiplied and broke up, with social issues and societal impact increasingly addressed through studies of human-wildlife interactions and the impact of land use change on wilderness areas and wild animals. Respondents were asked to name their current research discipline to see if this gradual change was reflected in how they viewed their work. In addition to the 17 choices of discipline provided by the survey question, which had been guided by analysing the topics described in the original research permit list, respondents reported 21 other disciplines and sub-disciplines. Six (16%) of those who responded to this question with a comment indicating *Other* named more than one discipline.

The disciplines named were coded into three broad categories: natural sciences, social sciences, and both. The coding for 'both' (see Figure 5-2) was constructed in two ways: (1) by individual discipline (e.g. climate change adaptation) and (2) where the respondent specified both a natural sciences and a social sciences category. Table 5-1 shows how the disciplines and sub-disciplines were coded into the categories, and Figure 5-2 presents the result.

Table 5-1 Current disciplines as indicated by respondents

	Natural Sciences	Social Sciences	Both
Discipline selected by survey respondent from a pre-determined list	• Biology • Chemistry • Conservation Science • Earth Sciences • Ecology • Entomology • Hydrology • Ornithology • Plant Sciences • Soil Science • Veterinary Science • Zoology	• Anthropology • Economics • Political Studies	• Geography • Land Use Planning
Discipline supplied by survey respondent as part of an 'Other' option	• Animal Physiology • Aquatic Parasitology and Ecology • Biogeochemistry • Botany • Conservation Biology • Conservation Genetics • Conservation Science • Evolutionary Genetics • Geology • Landscape Ecology • Mammology • Physiology • Plant Ecology • Savanna Systems • Wildlife Management	• Infrastructure Planning • Marketing & Tourism • Sociology • Tourism • Tourism Management and Marketing	• Climate Change Adaptation • Coupled Natural-Human Systems (CNH) • Environmental Science • Ethnobiology • Extractive Industries • Human Dimensions of Wildlife Conservation • Human-Environment Interactions • Land Change Science • Political Ecology • Rangeland Management • Socio-Ecological Systems (SES) • Sustainable Development • Tourism Geography

According to Figure 5-2, 80% of the respondents reported their current discipline as still belonging to the natural sciences, with ecology, conservation science and zoology named most frequently.

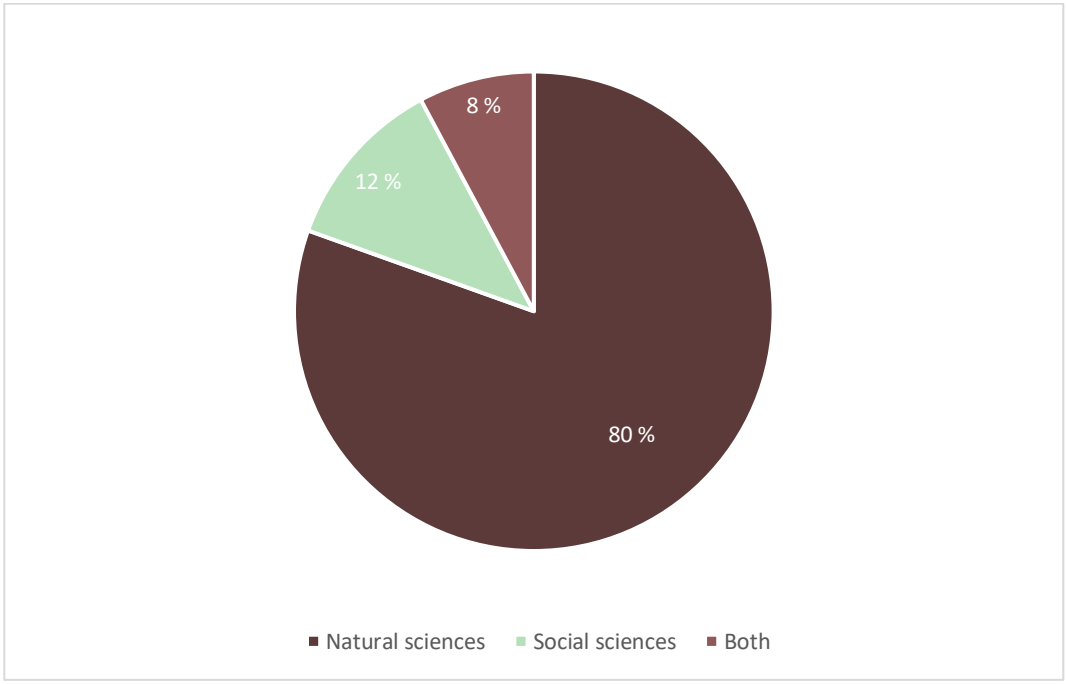


Figure 5-2 Current discipline of respondent (n=128)

5.2.3 Geographic location of research

Productive interactions between researchers and other stakeholders could be influenced by the geographic location of research, if, for example, locations are remote from towns and other population centres, or if certain locations are favoured for their conditions such as rich biodiversity. Respondents were asked to report the final location of their research. Figure 5-3 summarises their responses.

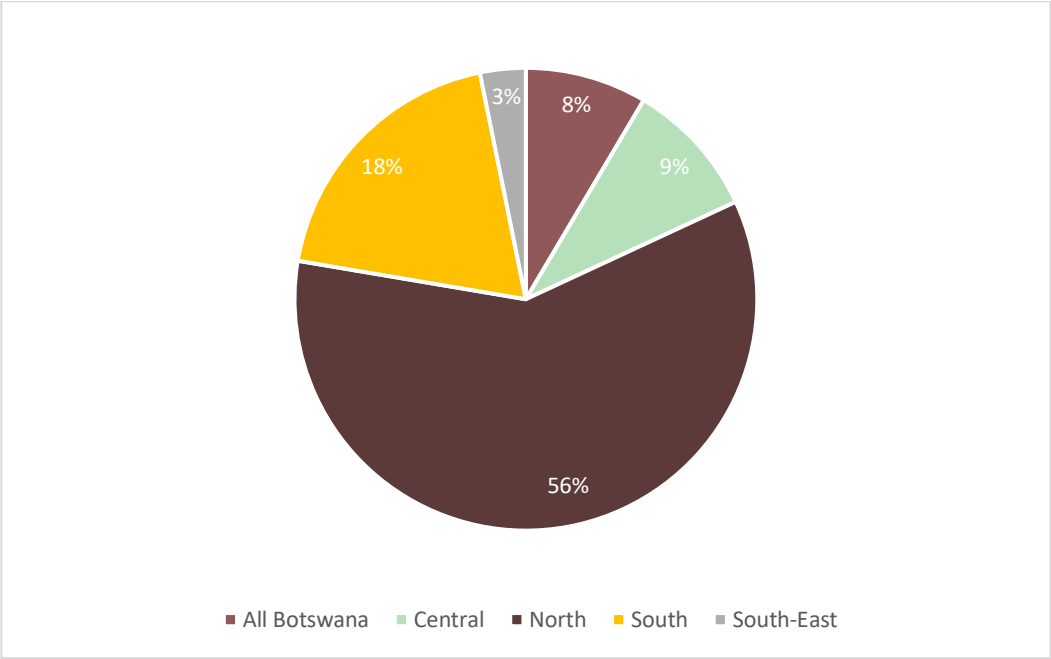


Figure 5-3 Broad geographic breakdown of all research locations (n=119)

More than half of the research projects that took place under the surveyed permits was carried out in Botswana's north, described in Botswana's aerial wildlife census as the open wildlife northern conservation system area, including the Okavango region and the Savuti-Mababe-Linyanti ecosystem (Chase, 2011). At least 49% of these (within the North chart category) were carried out in protected areas: the Okavango Delta Ramsar site, including Moremi Game Reserve, in Chobe National Park and in Makgadikgadi and Nxai Pans. Approximately 44% of the studies took place in protected areas in other sections of the country (all other chart categories) including the Central Kalahari Game Reserve, which, because of the natural migration patterns of wildlife, are often considered functional parts of the northern Botswana wildlife region. The map reproduced in Figure 5-4 shows the distribution of these protected areas (Natural Resources and People, 2009).

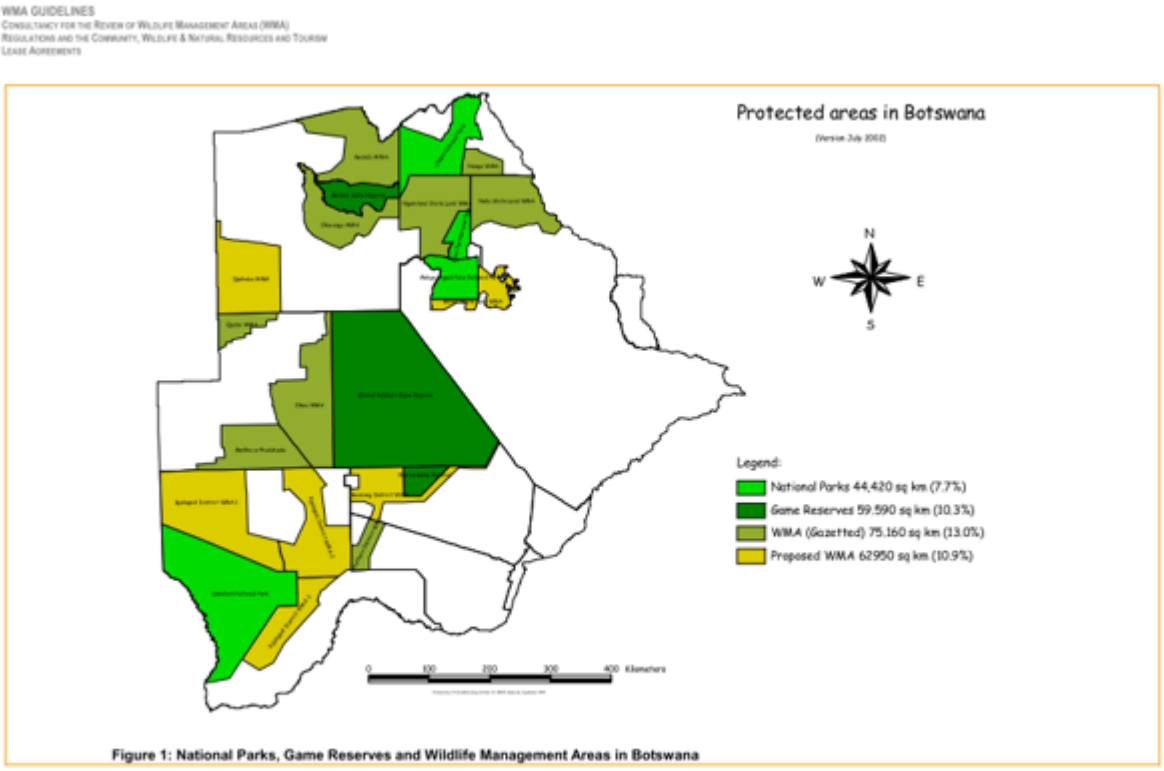


Figure 1: National Parks, Game Reserves and Wildlife Management Areas in Botswana

Figure 5-4 Map of protected areas of Botswana

5.2.4 Long-term engagement with Botswana

Commitment to long-term wildlife research in a region can lead to increased productive interactions as researchers become more knowledgeable about environmental and political contexts, and familiar with stakeholders. It also seems likely that continued work in a country or location would provide the opportunity to observe any uptake of completed research. Chapter 4 describes the geographic analysis of all research permits included in the overall study. Included here is an observation about the effect of longer-term engagement from the survey responses.

One pattern of researcher engagement in Botswana is for a graduate student to complete a study under one degree, and then return for follow-up work, often to obtain another degree. In the process of engagement with other stakeholders, the idea to form an organisation that would support ongoing research in the country sometimes takes shape. There are different ways this has been done by foreign researchers: one is through creating a non-profit foundation in the researcher's home country to raise funds to support more research. Another is by creating a trust or NGO in Botswana that raises funds through creating project proposals. In both cases, the Government of Botswana requires registration of the organisation as a non-profit body. Some long-term researchers, on the other hand, register a private business and operate as a consultancy. Citizen researchers, if they stay

in the country, have several options for local employment, among them the Botswana government system, a local university or research institute, a local or international NGO based in Botswana, or a consultancy.

The survey responses reveal a complex mix of engagement in wildlife conservation, management and research in Botswana that is constantly evolving and that contributes to the long-term involvement and interactions that can contribute to better understanding and uptake of research. Responses to the survey question about professional status at the time of initiating the research, for example, illustrate this dynamic process. Table 5-2 shows some examples of the kinds of role shifts that take place over time.

Table 5-2 Examples of shifting professional roles

Professional consultant in the private sector (outside Africa) with affiliations with a university outside Africa, working in collaboration with a Botswana-based company."
"Student at University outside Africa and now (under same permit extension) professional researcher in NGO and associate fellow at two universities outside Africa."
"Initially a PhD student at a UK university. Then independent researcher. Then professional researcher in a NGO."
"Professional in private sector and student at South African University."
"I was a part time student and full time Camp Manager at [name of safari company] when I conducted my research."
"I was a student at a university outside Africa as well as a researcher at Dept of Wildlife and National Parks Botswana."

5.3 Participants' perceptions of the use of the permit research in policy and practice

This section reports the survey results from respondents' perception of the use of their research.

5.3.1 Overall perception of use

The key question presented to survey respondents was whether they believed the research they had carried out under the identified permit had been put to use in policy or practice. The survey asked about permits issued between 1996 and 2014 – an 18-year span – so it could be expected that there would have been enough time for at least some of the research carried out under these permits to be put to use.

The researchers were given four possible responses:

- Don't know
- No, not at all

- Yes, but I don't really have evidence
- Yes, and I have evidence that this has taken place.

Of 128 survey respondents, 120 (94%) responded to this question. Fifty-six (47%) responded that they did not know whether their research findings had been put to use, 30 (25%) said no, while 17 (14%) said that they thought so, but did not have evidence. Figure 5-5 illustrates this.

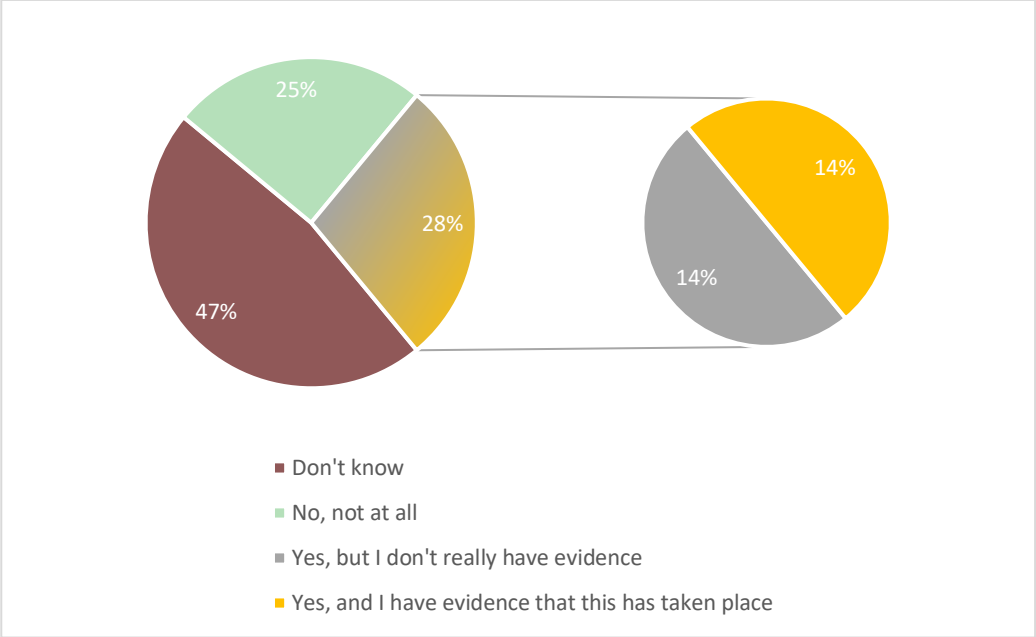


Figure 5-5 Research findings put into use (n=120)

The question about overall perception of research use was followed by a request to describe, in an open-ended response**,** *by whom*, and *how*, the research had been put to use. Analyses of the users and uses of research appear next in section 5.3.2.

5.3.2 Users and uses of research

For the 34 respondents (28%, Figure 5-5 above) who said that their research had been put to use, the different entities (users) provided have been coded into six categories. These are shown in Figure 5-6. The percentages do not add to 100% because more than one response was possible.

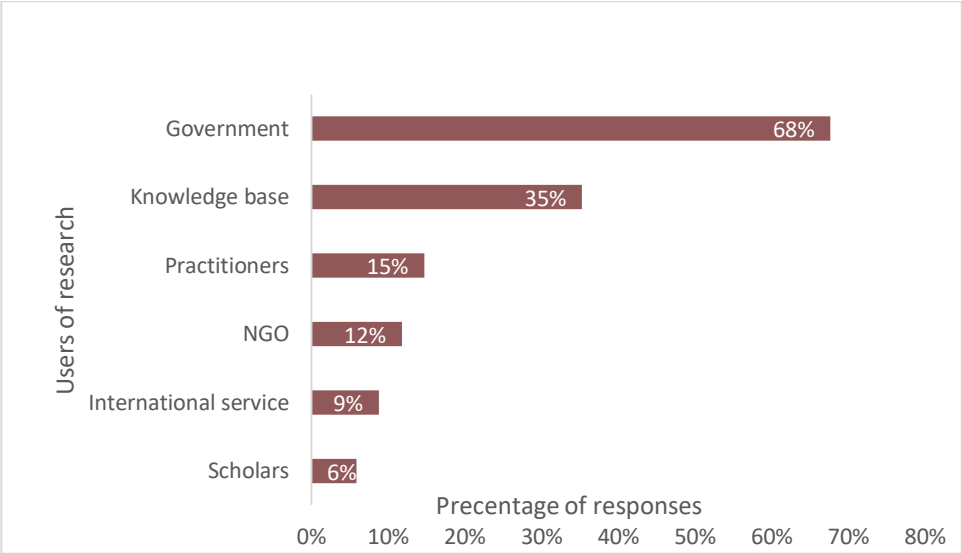


Figure 5-6 Users of research findings (n=34)

Government was mentioned most (Figure 5-6: 68%) as a user of the research produced under permit, followed by knowledge base – when findings were re-used in compilations used as reference works such as field guides, updated maps, IUCN Red List, for example (35%).

Figure 5-7 shows how those who reported use described the ways their research had been put to use, coded from the open responses. The three most common uses (Figure 5-7) were management practice (47%), planning (32%), and policy (27%).

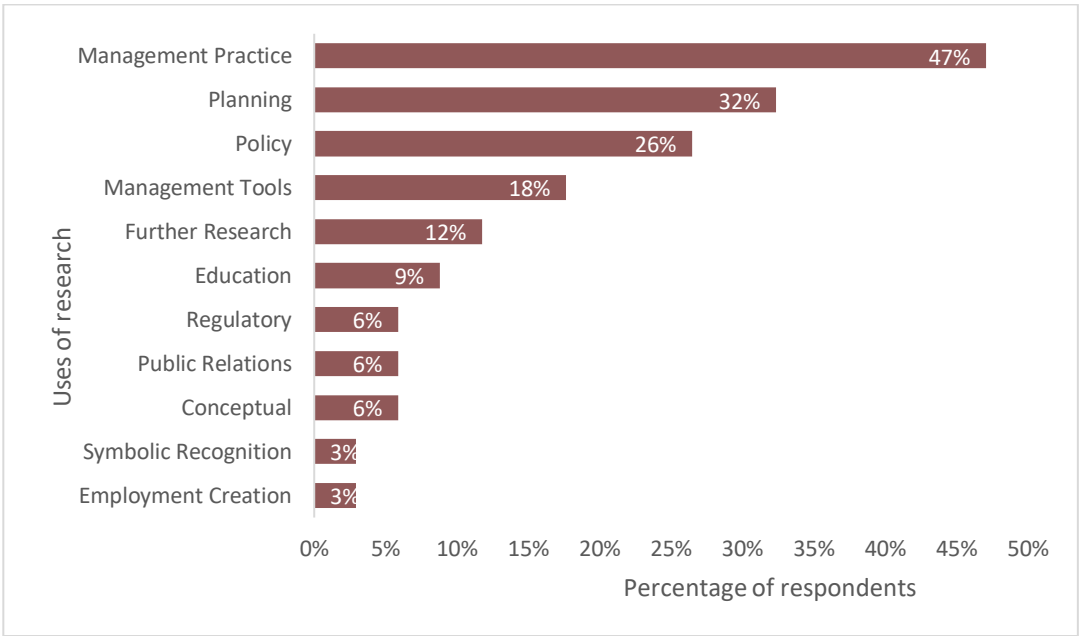


Figure 5-7 Uses of research findings (n=34)

The most use of research findings described was application to management practice and planning linked to specific geographic locations, protected areas, and populations. Table 5-3 provides some examples.

Table 5-3 Examples of types of use of research findings

Type of use	Category	Example [relevant stakeholder appears in brackets]
Animal husbandry (game ranching)	Management Practice	*"Not in policy but yes in practice: on the farm, and on my farm now."* **[Student at Botswana university]**
Land use regulation	Regulatory	*"I contributed my data to the Land Use Conflict Identification Strategy for Tawana Land Board. This helped inform the GIS modelling and has contributed to the establishment of 13 elephant corridors."* **[Student at university outside Africa]**
Planning, Protected Area delineation	Planning, Regulatory	*"Used in the development of a management and development plan for the Makgadikgadi Wetlands and in the formulation of the establishment of a flamingo sanctuary.*" **[Student at university outside Africa]**
Population management	Management Practice	*"Still ongoing in management of five of the privately owned/managed rhino populations in Botswana.*" **[Student at South African university]**
Population management	Management Practice	*"The Boteti fence is currently being moved.*" **[Student at university outside Africa]**
Population management	Management Practice	*"Primarily the DWNP PAC officers and veterinarians. We hosted a workshop to discuss predator translocations and are regularly asked to assist in these when animals are brought to our study area."* **[Professional researcher in NGO]**
Resource regulation	Regulatory	*"Via Fisheries, closed season for fishing during breeding period of Cichlids, some regulation on mesh sizes used for gill net fishing."* **[Professional researcher in South African university]**

5.4 Relationship between participant characteristics and perception of use

The relationship between researchers' professional status, scholarly discipline, research location, and length of time spent in Botswana, and their perception of use of their research, was explored.

5.4.1 Professional status and perception of use

It is possible that researchers with more experience, or those who are engaged in applying their research as part of their work in non-academic settings such as NGOs or the private sector, perceive that their findings are put to use more than do students or scientific curiosity-motivated specialists. The question there is whether professional affiliation affected perceptions of research use. The professional affiliation categories set out in the survey (see again Figure 5-1) were consolidated into four to allow analysis of whether professional affiliation had a role to play in interactions and uptake of research. The four categories used were:

- Students
- Researchers at academic institutions
- Researchers in the private sector
- Researchers in NGOs.

More than half of the respondents (55%) were students when they received their research permit, according to Figure 5-8. The next largest group was professional researchers in academic institutions (30%). Fifteen percent of respondents did not work at an academic institution.

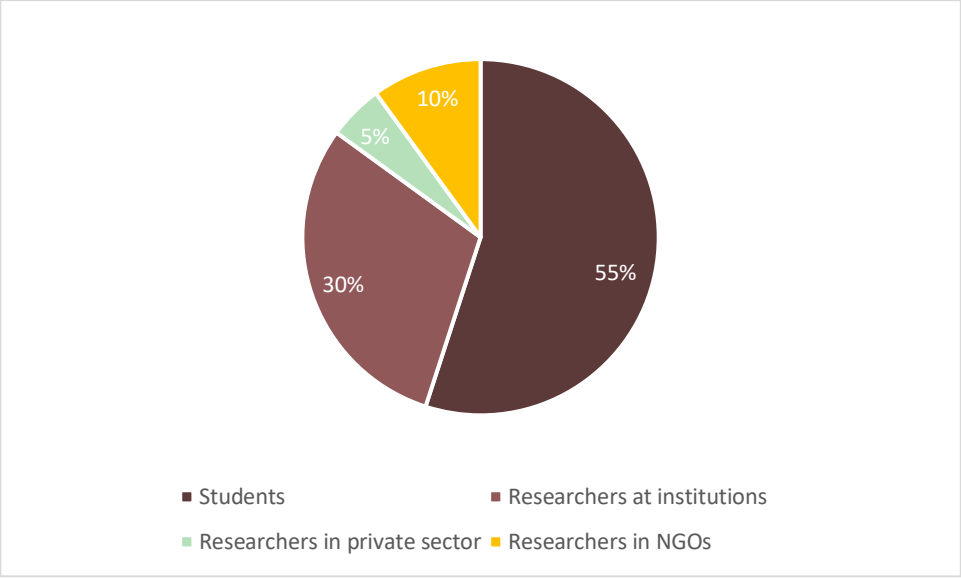


Figure 5-8 Professional status of principal investigators (n=128)

These four categories were cross-tabulated with responses as to whether the researchers perceived that their research had been used: the result of this are shown in Figure 5-9.

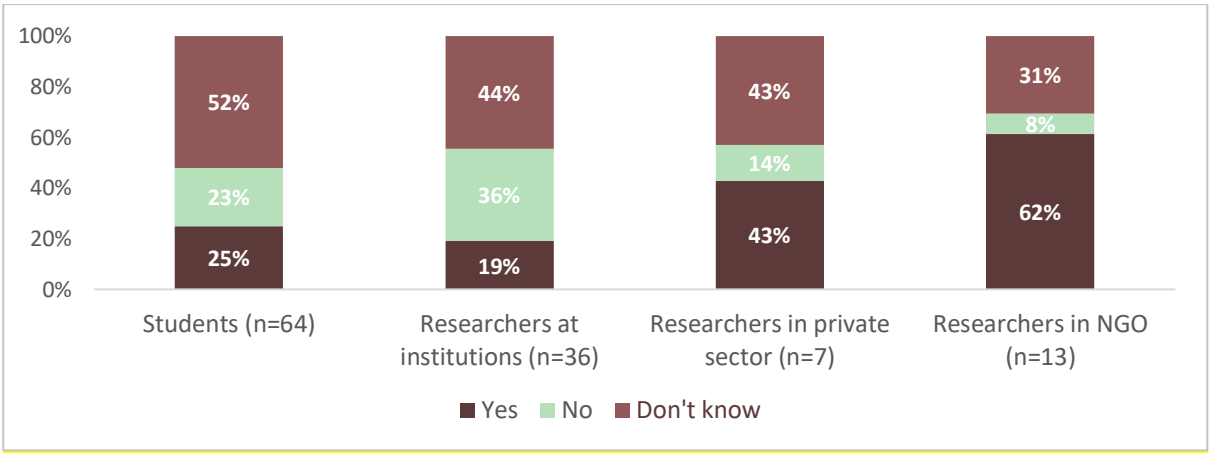


Figure 5-9 Perception of use, by professional status at time of research

Note: The following statistically significant difference ($p<0.05$) was observed, based on a Bonferroni test for comparison of proportions: "Researchers in NGO" (62% yes) > "Researchers at institutions" (19 % yes).

Researchers in NGOs (62%) and the private sector (43%) reported most that their research was used, while researchers in academic institutions reported the least use (19%): a significant difference between the perceptions of NGO and researchers from academic institutions was found.

5.4.2 Scholarly discipline and perception of use

Researchers who work on topics applied to social problems that could be solved might be expected to see their research put to use more than scientists focused observing natural processes. It is worth exploring if there was a relationship between a researcher's current discipline and their perception of whether their research had been used. Figure 5-10 compares the perceptions of survey respondents by discipline.

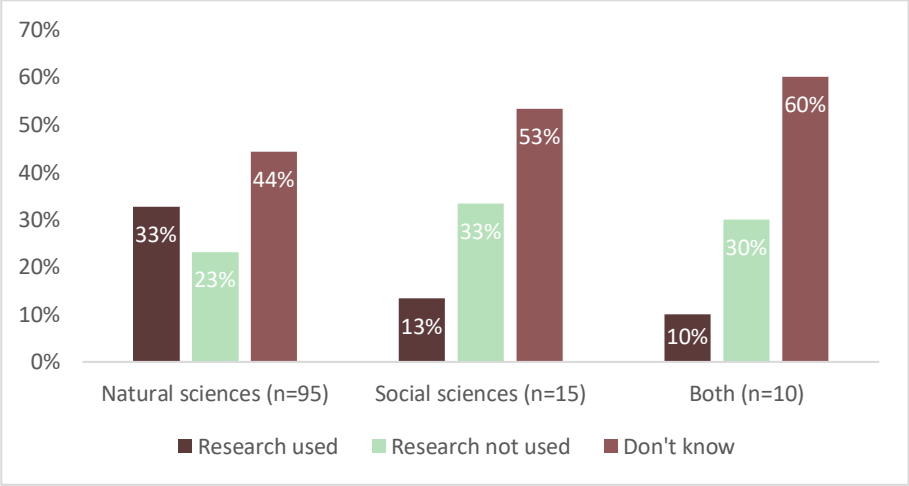


Figure 5-10 Perception of use by discipline

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

No statistically significant differences were observed. Without putting too much emphasis on non-significant differences, there nevertheless appears a tendency for researchers in the natural sciences to show a pattern of greater confidence in the use of their research, with the greatest difference (33%, compared with social sciences at 13%, and combined disciplines at 10%) in responses that indicated use of research.

5.4.3 Geographic location of research and perception of use

Most of the work produced under the studied permits was carried out in Botswana's north. It might be useful to see if there was any relationship between the geographic location of the research and the perception of research use. Figure 5-11 shows the result of this investigation.

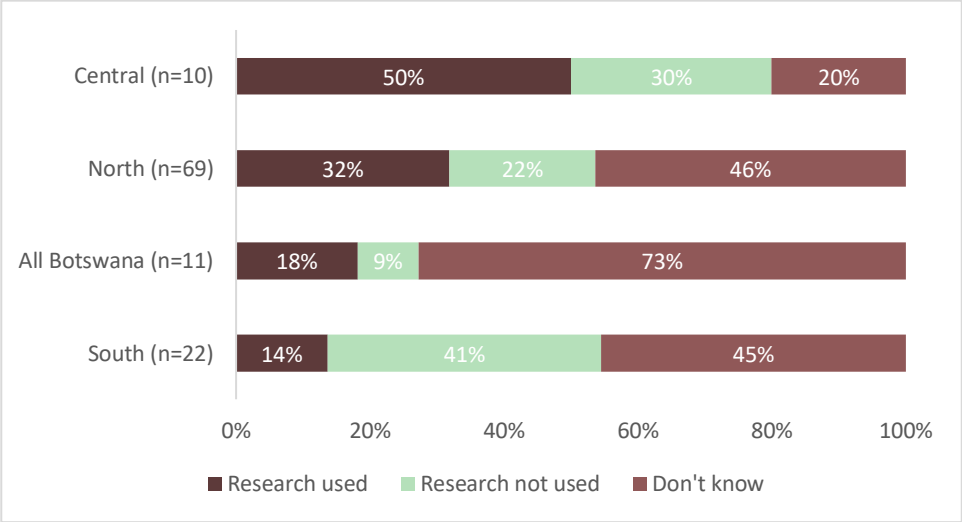


Figure 5-11 Location of research by perception of use

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

There were only four permits (3%) for work carried out in the south-east of the country (Tuli area). For the other regions, when combined with corresponding perceptions of use, those respondents who had worked in central part of the country – mostly identified as the Kalahari – perceived most (50%) that their work had been used. By comparison, 32% of those who had worked in the north believed that their work had been put to use.

5.4.4 Long-term research and perception of use

The amount of time spent carrying out research in the country would seem to indicate that the degree of familiarity of a researcher with conditions in the local environment lead to more knowledge of the study topic, to better social networks, and to understanding of interests and needs of local practitioners and managers. Perceptions of research use were analysed for survey respondents who were known, through follow-up contacts, to be still working in Botswana in 2018.

Of 120 respondents who answered the question about whether their research had been put to use, 51 were still working in Botswana (categorised as long-term), and 69 (categorised as short-term) were no longer working in the country as of 2018. Responses of these two groups were compared, as shown in Figure 5-12.

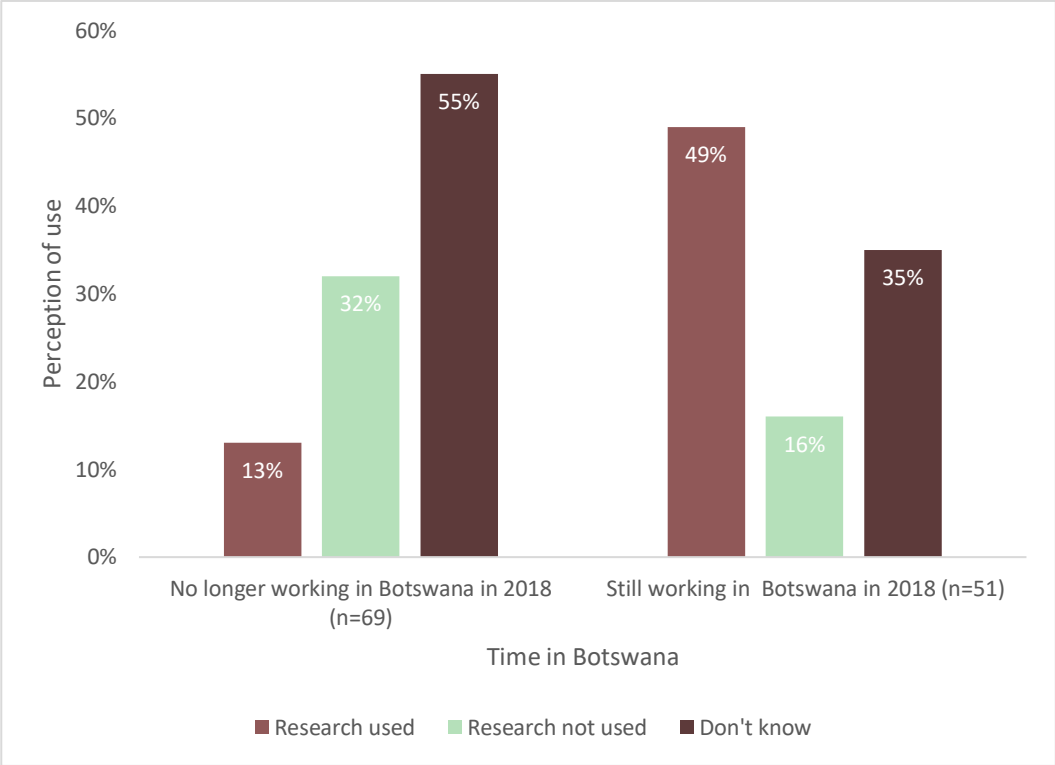


Figure 5-12 Perception of use by length of time in Botswana (n=120)

The following statistically significant differences ($p<0.05$) were observed, based on the Bonferroni test for comparison of proportions:

"Still working in Botswana" (49% research used) > "No longer working in Botswana" (13% research used)

"No longer working in Botswana" (32% research not used) > "Still working in Botswana" (16% research not used)

"No longer working in Botswana" (55% don't know) > "Still working in Botswana" (35% don't know).

The comparison shows that significantly more researchers still working in Botswana in 2018 perceived that their work was used for work carried out under the permits studied (49%) than did those who were no longer working in the country (13%).

5.5 Relationship of participants' research–stakeholder interactions and perceptions of use

Wildlife research takes place through a series of stages, beginning with identification of research topic and location, moving through selection of collaborators, fieldwork activities, processing of findings, and publication and dissemination of results. Interactions with stakeholders of research can take place at any of these stages: studies of research uptake have increasingly emphasised the

importance of engaging potential users of the research from the beginning of this process. For this reason, the survey asked respondents about their interactions during the stages of planning, data collection, analysis and sharing of their Botswana research:

- Choice of research topic
- Choice of Botswana as research location
- Fieldwork interactions with government officials, local communities, other researchers from Botswana, other researchers from outside the country, and with Botswana NGOs
- Writing up of findings
- Sharing of findings.

5.5.1 Interactions with stakeholders in the planning of research

> *"I was initially looking for a PhD project and got in touch with [names of two other Botswana-based researchers] to see if I could carry out such a PhD with them but it couldn't be done in the timeframe I had. [Name of researcher] suggested I went to the Director of Research of DWNP in Maun and talked to him. I did tell this person I was willing to do a survey for DWNP at my expense. He suggested the survey I did carry out as it was something of interest and object of speculation for DWNP. I did pay all the costs except fees for Moremi as DWNP let us stay for free on the staff side of the camps in exchange for the survey. We did liaise with the DWNP ranger who was Head of South Gate then and who accompanied us often on field surveys with an objective of capacity building at the request of the Head of Research."* **[Researcher from foreign university (RP001)]**

While the account in this interview excerpt describes how a research topic may evolve through a chain of interactions in a network of research stakeholders to result in work that is relevant to local users, identification of research priorities and geographic location can take place without reference to issues considered important to stakeholders in a selected region. If there is a perception that research topics are often based on external concerns and influences that are not relevant to local interests, uptake of the research may be compromised. Six categories of motivation for selection of topic and location were added by respondents to the original six provided by the survey and incorporated in the analysis. Did how the researchers surveyed choose their research topic relate to how well they perceived the research was put to use? Table 5-4 compares responses to this question.

Table 5-4 Topic choice and perception of research use

Motivations for research	All respondents (n=128)	Research use		
		Yes (n=40)	No (n=30)	Don't know (n=36)
Background reading about species or issue	41%	41%	40%	43%

Motivations for research	All respondents (n=128)	Research use		
		Yes (n=40)	No (n=30)	Don't know (n=36)
Discussion with colleagues already working on the topic	25%	24%	27%	23%
Suggestion by research supervisor	21%	9%	17%	29%
Observed problem	19%	32%	7%	18%
Priority identified by DWNP Wildlife Conservation Research Strategic Plan	18%	35%	10%	13%
Previous research	14%	9%	10%	20%
Personal choice	12%	12%	13%	13%
Request by NGO or other sponsor	9%	9%	3%	11%
Unique conditions	6%	3%	3%	11%
Commissioned research specified the topic	3%	6%	0%	2%
Research institution priority	2%	0%	0%	4%
Community priority	1%	0%	0%	2%

Note that 22 respondents did not answer the question about whether their research had been used.

The single most important motivation was *Background reading about species or issue,* with 50 responses (41%). This motivation was equally important across all three use categories. The same applies to the second most important motivation, *Discussion with colleagues already working on the topic*, with 29 responses (45%).

Differences among the three groups are observed with regard to the two motivations: *Observed problem,* and *Priority identified by DWNP Wildlife Conservation Research Strategic Plan*. In each case, the 40 respondents reporting use were most likely to state these as motivations, 11 (32%) and 12 (35%). In fact, these two motivations are among the three most frequently mentioned among respondents in the "Yes" category. Examples of these motivations reported are in Table 5-5.

Table 5-5 Examples of motivations for research topic

Type of motivation	Example [relevant stakeholder appears in brackets]
Priority identified by DWNP	"*It was my passion to see myself working in the field of Ecology in the long run. In addition, it was within the perfect time-frame to do a follow-up to the implemented mitigation measures by DWNP*." **[Student at Botswana university]**
Priority identified by DWNP	*"These monitoring objectives were put forward in the Nile crocodile management plan (2007) developed for the DWNP by the Okavango Crocodile Research Group (2002-2007)."* **[Professional in the private sector]**
Priority identified by DWNP	*"Priority identified by DWNP Wildlife Department when proposal for a comprehensive study of CKGR was submitted."* **[Student at institution outside Africa]**
Observed problem, Priority identified by DWNP	*"Initial work indicated … and priority of elephant conservation then priority identified by DWNP 2012 onwards."* **[Professional researcher in NGO]**
Observed problem	*"Specific personal interest, after four years working on the Makgadikgadi system and wanting to know more about it."* **[Professional researcher in South African institution]**
Observed problem	*"Motivated by work that I did back in 2000, as field assistant of an ecological consultant."* **[Professional researcher in South African institution]**
Observed problem	*"I have worked and done research in Botswana for over 15 years and was trying to determine if there was a "browsing lawn" effect happening similar to the grazing lawn effect wherein large grazers increase the nutrient quality of their forage."* **[Professional researcher in NGO]**

5.5.2 Interactions with stakeholders during research fieldwork

> *"[Name of government official], of DWNP reviewed my proposal and made suggestions. He helped me to not duplicate what had been already done. The research was useful as it shows there is a need to separate the elephant from the villagers, perhaps through fencing, rather than relocating them. Contradictory attitudes could be resolved. The affected community needs to hear the results of this research before it is published elsewhere. I think this is really important. Better to expose the research to the people working on the ground as those working in Gaborone [the capital city] are not listening easily. I had intended to go back to present the findings to the community, but I haven't had time, and now I am going to be away in the USA for further study."* **[Local student at Botswana university (E004)]**

Interactions between researchers and the stakeholders who are potential users of the research findings are said to be needed throughout the research process to enable multi-directional exchange

of knowledge. For the principal investigators included in the survey, some interactions that involved exchange of knowledge took place during their Botswana fieldwork. These interactions were direct and indirect, and both formal and informal.

5.5.2.1 Stakeholders and types of interaction

The respondents were presented with five categories of stakeholders with whom they might have interacted with during the fieldwork of their permitted research. These were (1) the DWNP or other Botswana government officials, (2) people living in nearby communities, (3) other researchers permanently based in Botswana, (4) other researchers not permanently based in Botswana, and (5) a Botswana NGO. For each category, the respondents first had to indicate whether any interactions occurred while in the field. Where interactions did occur, a follow-up, open-ended, question asked for a brief description of the nature of the interaction.

Figure 5-13 shows, for each stakeholder category, the percentage of respondents who respectively interacted and did not interact with that stakeholder.

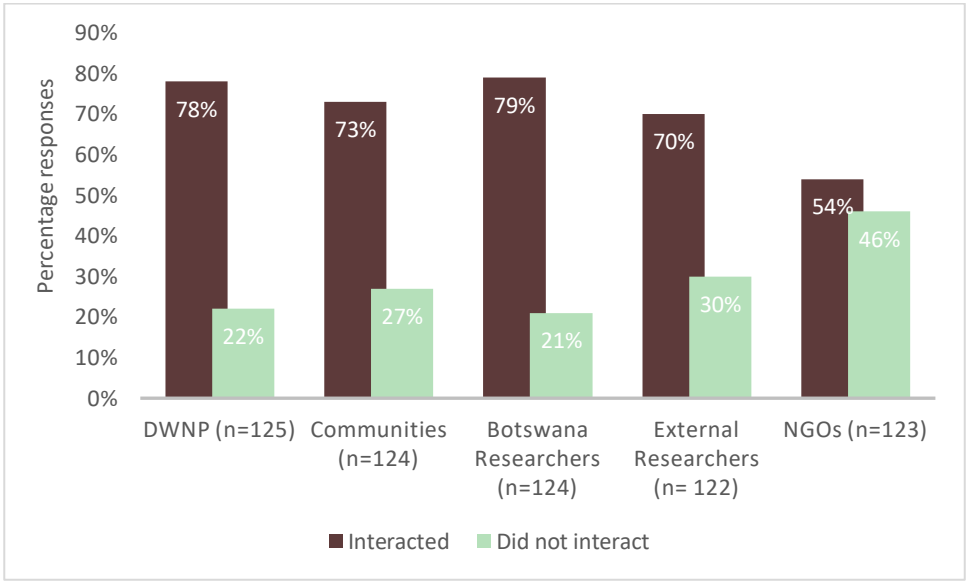


Figure 5-13 Interactions of researchers with five groups of stakeholders during fieldwork

Most respondents reported interactions with other researchers, government officials and communities (percentages ranging between 79% and 70%). Interactions with Botswana NGOs were fewer (54%).

Responses indicated a variety of engagements, including correspondence, participation in workshops and conferences, data and information sharing, and training opportunities. Survey responses were coded by supplying the 30 categories of interaction shown in Table 5-6.

Table 5-6 Categories of researcher-stakeholder interaction during fieldwork

Type	Brief description of respondent's activity	Number of Responses
Methodology	shared or discussed methodology relevant to project	105
Inclusion in research	worked together on relevant project	103
Meetings	initiated or participated in meetings with others	88
Interviews	carried out interviews with others	55
Discussions	talked with others about the work	49
Data sharing	compared and exchanged data	41
Logistical support	received logistical assistance	41
Information exchange	shared logistical or topical information, or news	37
Presentations	made formal presentations to others	31
Field encounters	met others in the field	25
Training	carried out training	25
Reports	provided reports	23
Conferences	interacted with others at conferences and workshops	21
Outreach	initiated deliberate, formal sharing of project information with non-academic stakeholders	20
Funding	received financial or in-kind support	16
Employment	included others in fieldwork through paid employment	12
Correspondence	exchanged information by letter or email	9
Location access	received permission to work in a location	9
Permissions	received permissions to interact or carry out specific activities	9
Joint management	worked together on interventions in the field	7
Proposals	worked with others on joint proposals	7
Fieldwork	conducted research with others in the field	5
Data collection	joined with others in collecting data	4
Enforcement	engaged with regulatory authorities	3
Records	accessed records of stakeholders	3
Publications	created publications with others	2
Sample analysis	submitted samples of substances for analysis	2
Advocacy support	benefitted from recommendations, publicity	1
International service	contributed data to international repository (e.g. IUCN Red List of Threatened Species)	1

Most common interactions during fieldwork were discussions of methodology, and inclusion in research. Most of these took place with other researchers. Interactions with other stakeholders such as the DWNP, community members, and NGOs were most common in the form of meetings. Most interactions with community members took place through interviews, and employment of community members as guides and logistical support staff.

Looking at whether there was a relationship between researchers' interactions with different stakeholders and their perception that their research was put to use, the survey data show little difference among categories of stakeholders: any researchers who interacted with others indicated higher confidence that their work had been put to use, irrespective of which category of stakeholder was involved. Figures 5-14 to 5-18 and related tables illustrate, for each category of stakeholder, the perceptions of use in relation to their interactions with researchers.

5.5.2.1.1 Interactions with government officials

For external researchers coming to Botswana to carry out fieldwork, their first encounter with government officials may take place at offices in the capital city, Gaborone, 1000 km south of the researchers' destination.

> *"I visited offices of [government] officials in both Gaborone and Maun. I chose those people through reviewing literature and organisation directories. The officials helped by offering their opinion, and support for my work, but they did not review my proposal in detail. Most government officials expressed their lack of knowledge about the topic – very few of them had grown up in northern Botswana. Most of them did indicate a strong interest in what I would discover."* **[Student at a foreign university (E003)]**

Whether these bureaucratic encounters, carried out voluntarily by the visiting researchers, result in awareness that leads to uptake of the research is debated:

> *"I have been coming to Botswana for research for years, and always make a point of visiting government officials in Gaborone to let them know what I am up to. One time I was stopped in the corridor by one official who said to me, 'You come and do your research but you don't share it with us after you leave'. I took him by the hand and led him to the departmental library where I showed him the copies of the reports I had sent."*
> **[Professional researcher at a foreign university (E007)]**

Figure 5-14 illustrates interactions with the DWNP and perception of use.

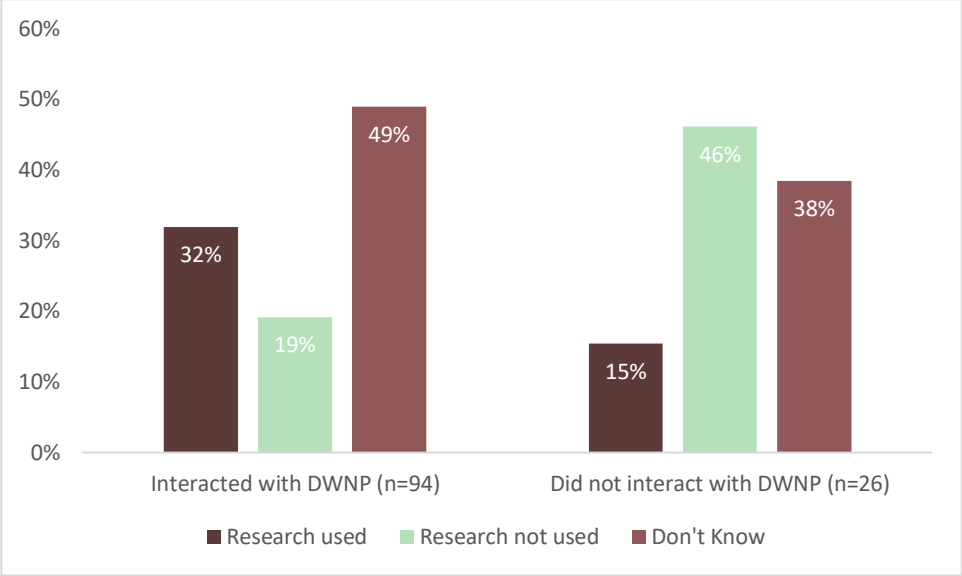


Figure 5-14 Interactions with DWNP and perception of use

Note: The following statistically significant difference ($p<0.05$) was observed, according to a Bonferroni test for comparison of proportions "Did not interact with DWNP" (46% research not used) > "Interacted with DWNP" (19% research not used)

Interacting with the DWNP is associated with markedly higher instances of perceived use than where no interaction with the DWNP was reported (32% vs 15%). For those who did not interact with the DWNP, 46% reported no use, as opposed to 19% for those who did interact with the DWNP. A substantial number of respondents, irrespective of interacting with the government or not, did not know whether their research had been put to use (49% and 38%).

Interactions between researchers and government officials in the field are meant to take place through reporting to the appropriate district office. This does not always happen: DWNP research officials in Maun reported in interviews that they are often not aware that specific research is taking place in the region, as the visiting researchers do not contact the local office and the local official are not notified by headquarters staff that research permits have been issued **[Government officials (G025-028)]**.

But when unplanned interactions happen, they build awareness and trust:

> *"Sharing current information about animal movements is satisfying. DWNP was very interested in the transboundary work. I used to stop and talk with the DWNP guy when I passed through the gates. I remember telling one of them that there were holes in the fence and he actually went out for a look. Then there was a collared lion in Sankuyu killing goats. I would keep the problem animal control guys informed when it moved, as I could track it. They really liked this."* **[Student at foreign university (E017)]**

Table 5-7 show the types of interactions with DWNP or other government officials reported by respondents: it was possible for a respondent to report more than one type of interaction.

Table 5-7 Types of interaction with government during fieldwork (n=94)

Type	Number of Responses	Percentage
Meetings	34	36%
Inclusion in research	26	28%
Reports	20	21%
Field encounters	12	13%
Interviews	11	12%
Presentations	11	12%
Training	9	10%
Information	8	9%
Location access	7	7%
Data sharing	5	5%
Joint management	5	5%
Conferences	4	4%
Logistical support	4	4%
Data collection	3	3%
Enforcement	3	3%
Records	3	3%
Correspondence	2	2%
Methodology	2	2%
Outreach	1	1%
Proposals	1	1%

Of 120 responses, 94 (78%) reported that they had had interactions with DWNP or other government officials during their fieldwork period. Most of the interactions (35%) involved meetings, with the next highest category being inclusion of government officials in research (27%). The types of interactions with government officials were the most varied among the stakeholders, with 20 different types of interaction reported in comparison to 16 for communities, 17 for Botswana researchers, 16 for external researchers, and 17 for NGOs.

Interactions between government officials and researchers in the field that are deliberate and planned, including engagement in joint work, appear to point the way to more uptake, but these interactions tend to take place when researchers have established a longer-term presence in the region, or are team members on a larger project approved by government.

> *"Collaboration is important. I have been to Maun and taken my [DWNP] colleagues to [name of NGO manager]'s office, and to [name of another NGO]. I say, 'We want you guys to have a role in what the project is doing.'"* **[Senior government official (E026)]**

> *"We worked on carnivore distribution in relation to prey abundance at [name of district] with the Okavango Research Institute. We found that there was an increase in carnivores in the eastern [name of protected area]. The recommendations made on utilization measures helped the local farmers as well as changed their perceptions towards carnivores. In spite of the fact that some decisions may be feasible, if the government is to enforce it there also is a need for the political buy-in."* **[Government official (G024)]**

> *"Some of our research work did have direct impact in the short term. For example, we found that there was pollution of water in the river from the two-stroke engines that boats were using. This led to most of these engines being removed. Actually quite a few recommendations from our project made their way into policy and practice."* **[Senior government official, former project manager (E011)]**

In some cases, however, planning for such interactions is influenced by deliberate selection of collaborators, as the following interview excerpt shows:

> *"[We interact with] any government people who are academically based or trained in outside universities. [Local university] students are not really exposed to the kind of thinking that promotes knowledge sharing. The culture here does not facilitate sharing. You get promoted by saying 'no' – you quickly learn not to share information."* **[Professional research consultant (E016)]**

In the survey responses, data sharing accounted for about 5% of interactions with government officials. Most researchers want to use government data to support their research but often find getting it difficult, which may account for the low percentage.

> *"Academics and government people like to stick to their own area: what they know. Government people say that they are dealing with issues on the ground and academics are not really helping with that. There is also fear of criticism: they give you their data and then you come back to point out their mistakes. But if people in government are open, it can help them. I have sometimes pointed out mistakes in data provided to me by government and they have been appreciative. Most of the data I get is done through an informal contact. If you try to get data from government through official channels, it can take forever. There are too many obstacles"* **[Researcher at Botswana institution (G020)]**

> *"The biggest problem in getting biodiversity data into use is the difficulty of accessing data that the Government of Botswana has. Government is sitting on a lot of data in the form of spreadsheets, databases, shape files, and KML files, but officials are reluctant to share it. When asked for specific data they will produce a part of it, it but they will not offer or suggest related sources. Frequently, they will refuse access to information and data, saying that the consultants who collected data and prepared reports do not wish that it be released. The problem exists even for specific government units – such as the BDF – that want to get data from other government units."* **[Consultant (G003)]**

5.5.2.1.2 Interactions with communities

A community member who works as an occasional guide, when interviewed, explained that interactions of community members with researchers could take place, but there was still lack of communication and understanding about the nature of research being carried out:

> *"… so we are discussing like 'you know what guys, we are sitting out there in town and I think we missing a lot in terms of research at some point. Maybe we could get something in terms of research, how we can share the information that you guys are finding out? And then they said "Oh no, we do with the government' and I was like 'you share with the government but the government doesn't take it to the public'."* **[Community member (RT008)]**

Figure 5-15 illustrates perceptions of use by whether researchers interacted with communities.

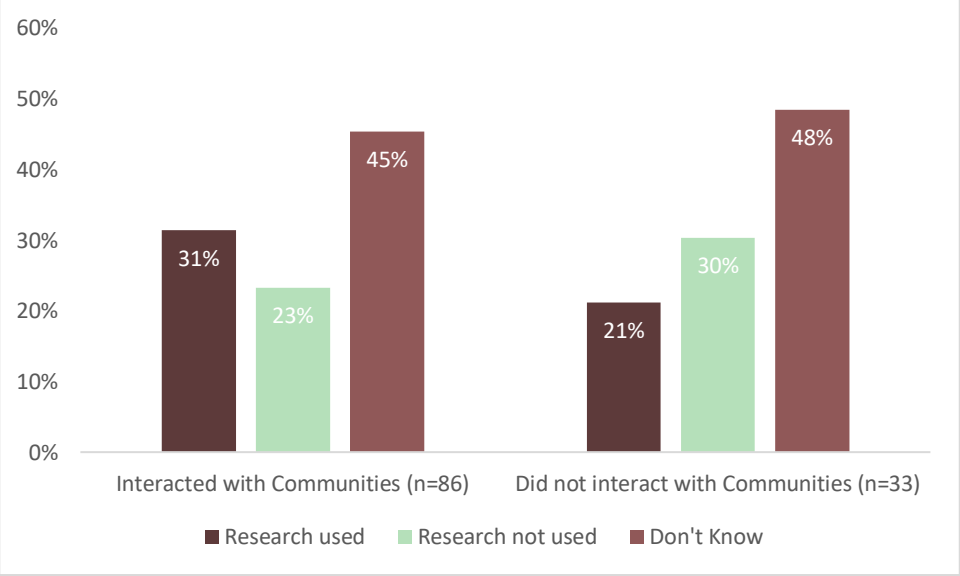


Figure 5-15 Interaction with communities and perceptions of use

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

As in the case of interactions with DWNP, a substantial number of respondents, irrespective of interacting with communities or not, did not know whether their research had been put to use (45% and 48%). There was no significant difference in perception of use between those who did and did not interact with communities, although there were slightly higher instances of perceived use than where no interaction with communities was reported (31% vs 21%). Table 5-8 shows how respondents interacted with communities.

Table 5-8 Types of interaction with communities (n=86)

Type	Number of Responses	Percentage
Interviews	38	42%
Discussions	25	28%

Type	Number of Responses	Percentage
Meetings	17	19%
Outreach	17	19%
Employment	12	13%
Inclusion in research	10	11%
Permissions	9	10%
Training	8	9%
Information	5	6%
Logistical support	5	6%
Location access	2	2%
Proposals	2	2%
Conferences	1	1%
Data collection	1	1%
Funding	1	1%
Joint management	1	1%

Of 119 responses, 86 (73%) reported that they had had interactions with local communities during their fieldwork period. Most of the interactions (42%) took place through interviews of community members (28%), the next highest category being discussions (28%).

Interactions that involved joint research activity accounted for 11% of survey responses. A researcher carrying out student wildlife counts with community escort guides reported in an interview:

> *"There is a lot of great benefits from the interactions and the time spent with each other, but I don't know if it would necessarily distil to use of data. ... So it is instilling a continuation of learning and just access to books, that kind of stuff. I would like to say that we learn probably a lot more than the guides learn, just by the students interacting and just spending more time, getting those experiences that you wouldn't get otherwise."* [**NGO researcher (RT011)]**

5.5.2.1.3 Interactions with Botswana researchers

When asked in an interview why he doesn't work more with citizen researchers, a non-citizen researcher responded that they choose collaborators based on trust, ethics, expertise, and access to funding and equipment.

> *"I like to stick to people I know, and we are very protective of our reputation. We like to work and publish with people who have proven track records. And, for us, we also like to work with people who have experience working with [our target species]."* **[Consultant (G018)]**

Figure 5-16 compares the reported interactions with Botswana researchers and perceptions of use.

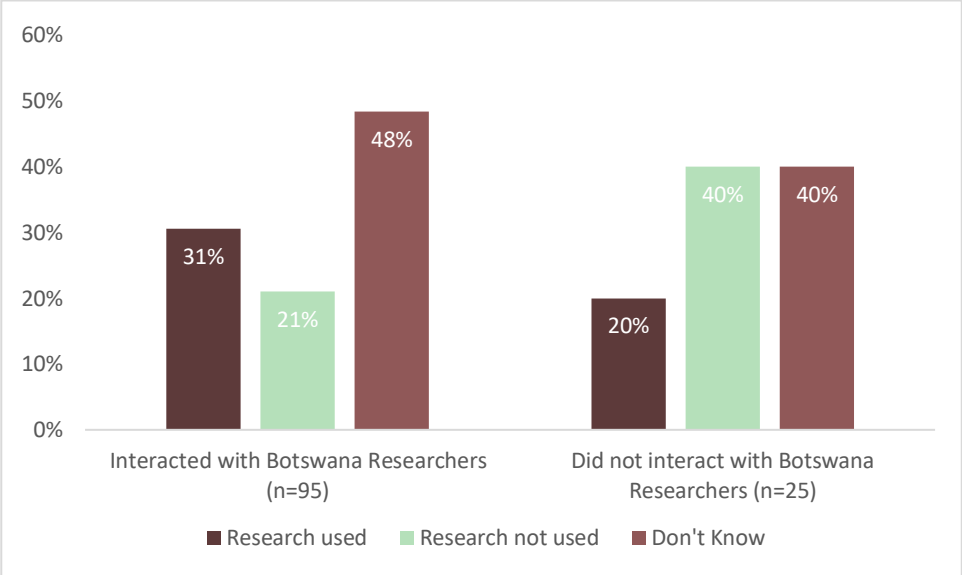


Figure 5-16 Interaction with Botswana researchers and perceptions of use

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Again, a substantial number of respondents, irrespective of interacting with Botswana researchers or not, did not know whether their research had been put to use (48% and 40%). While there was no significant difference, interacting with Botswana researchers was associated with slightly higher instances of perceived use than where no interaction with communities was reported (31% vs 20%). Those who did not interact with Botswana researchers were more likely to report that their research had not been used (40% and (21%). Table 5-9 shows for what purpose the survey respondents interacted with Botswana researchers.

Table 5-9 Types of interactions with Botswana researchers (n=95)

Type	Number of Responses	Percentage
Methodology	52	53%
Inclusion in research	33	34%
Logistical support	25	26%
Information	19	19%
Meetings	17	17%
Data sharing	13	13%
Discussions	10	10%
Conferences	9	9%
Presentations	4	4%

Type	Number of Responses	Percentage
Proposals	4	4%
Training	4	4%
Correspondence	3	3%
Interviews	3	3%
Field encounters	2	2%
Funding	2	2%
Advocacy support	1	1%

Of 120 responses, 95 (79%) reported that they had had interactions with researchers based in Botswana during their fieldwork period. Most of the interactions (53%) took place through discussions of methodology, the next highest category being inclusion of Botswana researchers in research (34%). Apart from increasing Government of Botswana pressure to include local students in work carried out under research permit, external researchers and Botswana-based NGOs appear to understand the usefulness of having this local connection but find achieving it difficult. Interviewed about this, a researcher at a Botswana-based NGO explained:

> *"We have worked at getting more local engagement in management and practice. We do not accept any foreign researchers at Master's level because we want to place citizens. For PhD work we have to take overseas students. I have yet to have one of my local students complete their Master's degree. About 50 percent of senior and junior wildlife biologist posts at district level are not filled. The government doesn't nourish its researchers."* **[NGO manager (E009)]**

5.5.2.1.4 Interactions with external researchers

Relationships formed during fieldwork with other researchers – especially those with a shared region of origin or research topic – appear to have considerable influence on how researchers view their research experience and perhaps point the way to uptake. Chapter 6 discusses this further through an analyses of acknowledgements made in theses and dissertations produced under the research permits studied. When asked about their interactions with helpful people during their fieldwork, external researchers interviewed tended to name other external researchers as having provided guidance and support in the form of methodology, local information including shared data, and advice **[(E013, E17)].** This is reflected in the survey responses.

Figure 5-17 illustrates interactions of respondents with external researchers in relation to perception of use.

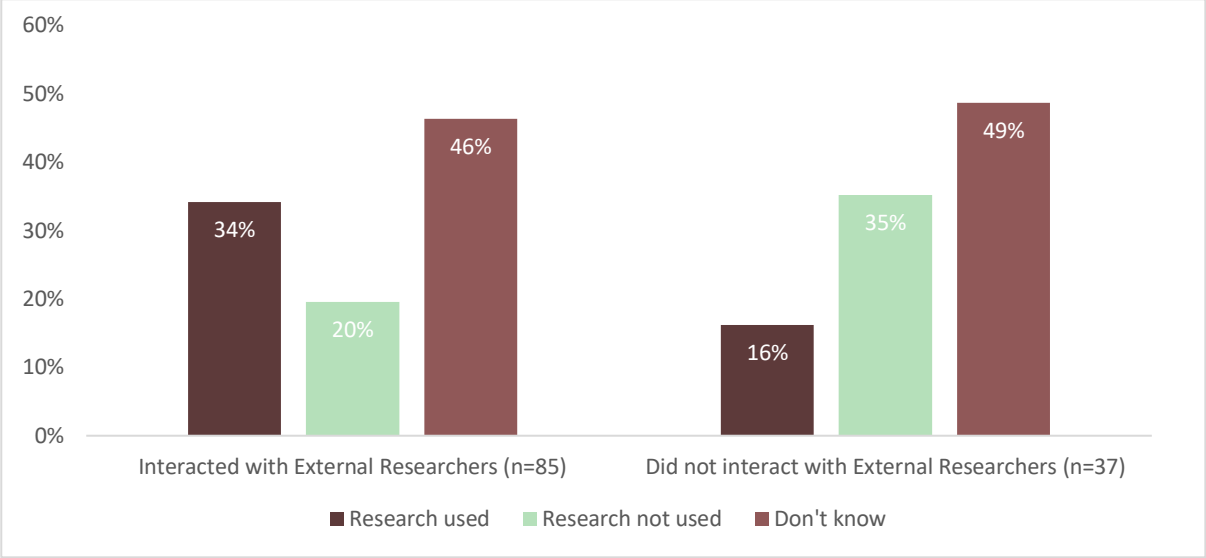


Figure 5-17 Interactions with external researchers and perception of use

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

As in the case of other stakeholder groups, a substantial number of respondents, irrespective of interacting with external researchers or not, did not know whether their research had been put to use (46% and 49%). While no statistical significance was observed, interacting with external researchers was associated with higher instances of perceived use than where no interaction were reported (34% vs 16%). Those who did not interact with external researchers were more likely to report that their research had not been used (35% and 20%).

Table 5-10 shows for what purpose respondents interacted with external researchers.

Table 5-10 Types of interactions with external researchers (n=85)

Type	Number of Responses	Percentage
Methodology	**45**	**53%**
Inclusion in research	**21**	**25%**
Data sharing	**14**	**16%**
Proposals	**11**	**13%**
Field encounters	**10**	**12%**
Meetings	**10**	**12%**
Discussions	**6**	**7%**
Conferences	**4**	**5%**
Logistical support	**4**	**5%**
Funding	**2**	**2%**
Presentations	**2**	**2%**

Type	Number of Responses	Percentage
Publications	**2**	**2%**
Sample analysis	**2**	**2%**
Training	**2**	**2%**
Information	**1**	**1%**
International service	**1**	**1%**

Of 122 responses, 85 (70%) reported that they had had interactions with external researchers during their fieldwork period. Most of the interactions (53%) involved discussions of methodology, with the next highest category being inclusion in research (25%).

5.5.2.1.5 Interactions with Botswana NGOs

Botswana-based NGOs that work with wildlife are research-oriented are potentially rich sources of information and support for other researchers. Their location and function as boundary workers – bridging the worlds of academic research and management practice – gives them a unique role in the northern Botswana community of practice. Many of the interactions of researchers with these organisations take place by virtue of their having arranged for external researchers' fieldwork to take place through the NGO, so these lead to interactions of the researchers with government, communities and with other researchers.

> *"We are collaborating with DWNP on a springbok study on request from the Research Division. We learned about their concern at a workshop at BWTI [Botswana Wildlife Training Institute] and had a conversation. We have also been working on a lion translocation study with DWNP for four years. And there are a lot of informal interactions. For example, we took a DWNP officer to a conference in D'Kar."* **[NGO manager (RP018)]**

Figure 5-18 illustrates interactions of respondents with Botswana NGOs in relation to perception of use.

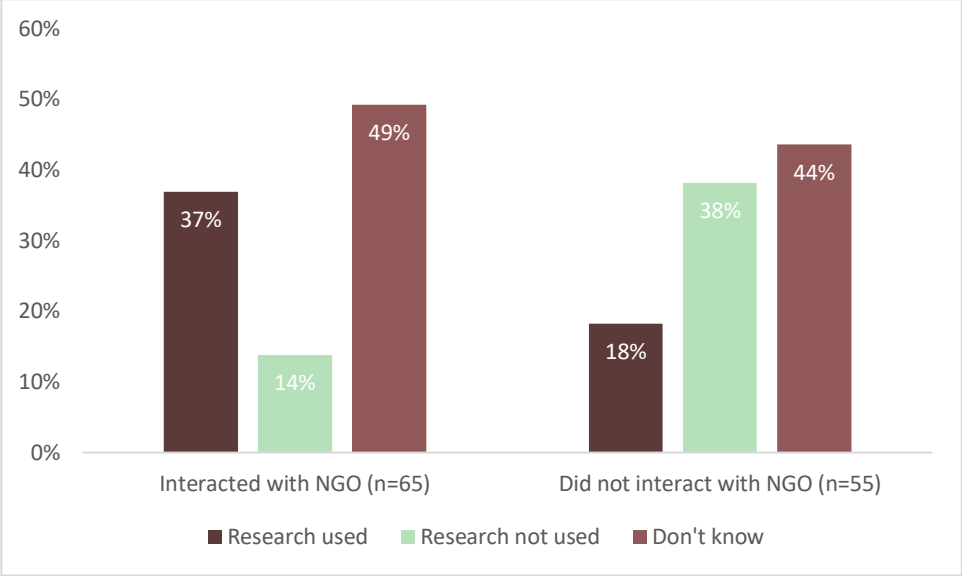


Figure 5-18 Interactions of respondents with Botswana NGOs in relation to perception of use

The following statistically significant differences ($p<0.05$) were observed, based on the Bonferroni test for comparison of proportions: "Interacted with NGO" (37% research used) > "Did not interact with NGO" (18% research used)
"Did not interact with NGO" (38% research not used) > "Interacted with NGO" (14% research not used).

As in the case of other stakeholder groups, a substantial number of respondents, irrespective of interacting with NGOs or not, did not know whether their research had been put to use (49% and 44%). There was a significant difference in this case as interacting with Botswana NGOs was associated with higher instances of perceived use than where no interaction with NGOs was reported (37% vs 18%). Those who did not interact with NGOs were more likely to report that their research had not been used (38% and 14%).

Table 5-11 Types of interactions with a Botswana NGO (n=65)

Type	Number of Responses	Percentage
Inclusion in research	**13**	**20%**
Funding	**11**	**17%**
Meetings	**9**	**14%**
Data sharing	**8**	**12%**
Discussions	**7**	**11%**
Fieldwork	**4**	**6%**
Information	**4**	**6%**
Conferences	**3**	**5%**
Interviews	**3**	**5%**
Logistical support	**3**	**5%**
Methodology	**3**	**5%**

Type	Number of Responses	Percentage
Proposals	**3**	**5%**
Reports	**3**	**5%**
Outreach	**2**	**3%**
Training	**2**	**3%**
Field encounters	**1**	**2%**
Joint management	**1**	**2%**

Of 123 responses, 65 (54%) reported that they had had interactions with a Botswana NGO during their fieldwork period. Most of the interactions (20%) were a result of inclusion of the NGO in research, with the next highest category (17%) being funding.

5.5.2.2 Feedback from government during and upon completion of fieldwork

> *"What is worrying is that we [NGO] researchers don't know if all the DWNP people we are dealing with really understand the gaps. We report to everybody, sending our quarterly reports by email. We submit our quarterly reports and the response has often been that the content is 'too complicated'. So we have simplified them to make them more accessible but I am not sure that anyone other than [name of senior government official] is reading them. Is anyone taking all the information that the NGOs are submitting and putting it together?"* **[NGO manager (G016)]**

Research permit guidelines require that researchers submit regular reports – usually quarterly – to DWNP offices nearest their research location, as well as final reports to Ministry headquarters. Approximately half of the survey respondents (52% out of 122) claimed that they had submitted these reports. Respondents were also asked if they had received comments, direction or feedback from government officials during their fieldwork, not necessarily in response to their reports. The responses to these questions are illustrated in Figure 5-19.

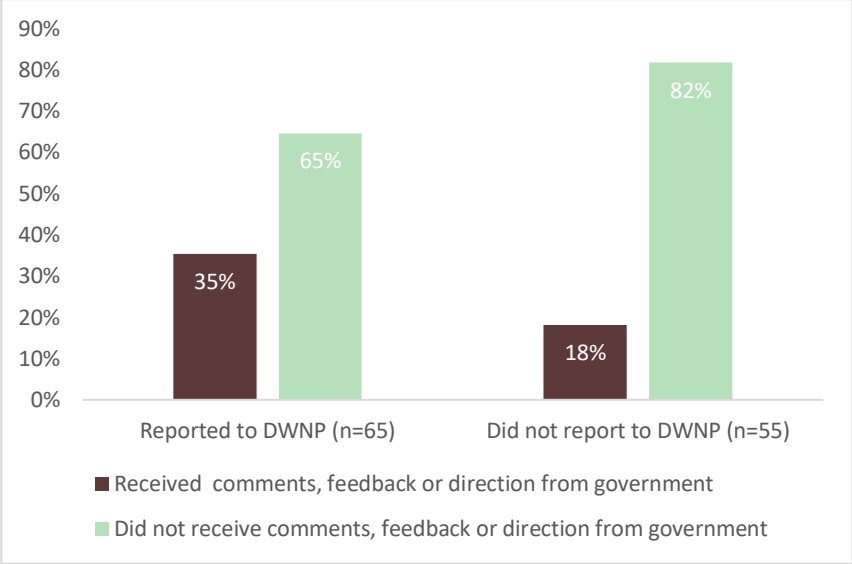


Figure 5-19 Reporting to DWNP by feedback received

The following statistically significant differences ($p<0.05$) were observed, based on the Bonferroni test for comparison of proportions:
"Reported to DWNP" (35% research comments) > "Did not report to DWNP" (18% received comments)
"Did not report to DWNP" (82% did not receive comments) > "Reported to DWNP" (65% did not receive comments

Of the 120 respondents who replied to the question about receiving feedback from government officials during their fieldwork, more of those (35%) who responded that they did report to the DWNP, received attention in the form of comments, feedback or direction during their fieldwork than did those who did not report (18%). Overall, many (73%) said that they had not received questions or comments on their work from the DWNP or other government bodies.

Sometimes feedback and action from government comes after indirect sharing of research findings, as the following excerpt from an interview shows.

> *"I and [name of other researcher] wrote an article for the newspaper about the need for adaptive management related to the Okavango floods. The Dept. of Water Affairs took note and contacted us, and that led to the department's planning for both surface and groundwater facilities to deal with future flooding."* **[Professional research consultant (G015)]**

5.5.2.3 Support from stakeholders during fieldwork

Another possible way of following interactions among researchers and stakeholders is to look at which stakeholders were considered to have offered and supplied support during the research process. Survey respondents were asked who had been most influential in the success of their fieldwork.

Six options were provided, of which one was *Other*. Respondents could then comment on any of their responses in a comment box. Apart from specifying the *Other*, some respondents also used the opportunity to indicate the types of support provided to explain why they regarded the 'who' as

most influential. The responses were coded into 14 categories of supporter (Figure 5-20), and 13 types of support (Figure 5-21).

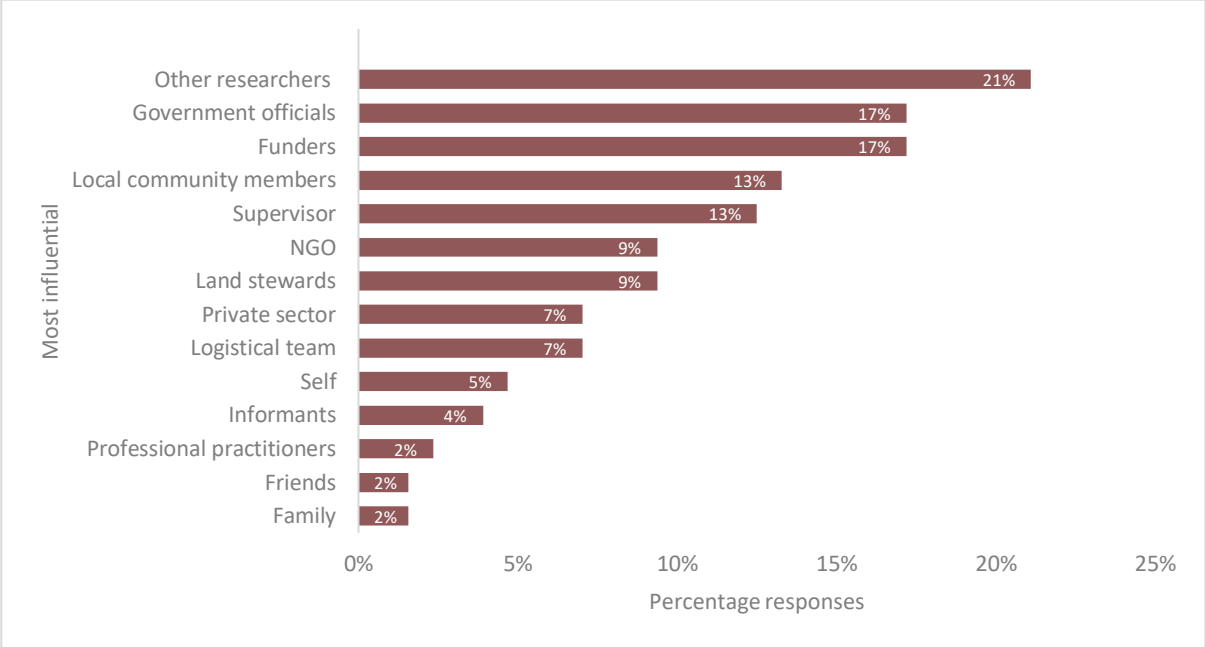


Figure 5-20 Most influential in success of fieldwork (n=127)

Other researchers (21%) appear to have been most important in supporting researchers in the field, followed by funders (17%) and government officials (17%). Community members were mentioned less frequently, at a level similar to supervisors (13%).

Figure 5-21 illustrates the types of assistance provided to these researchers in the field.

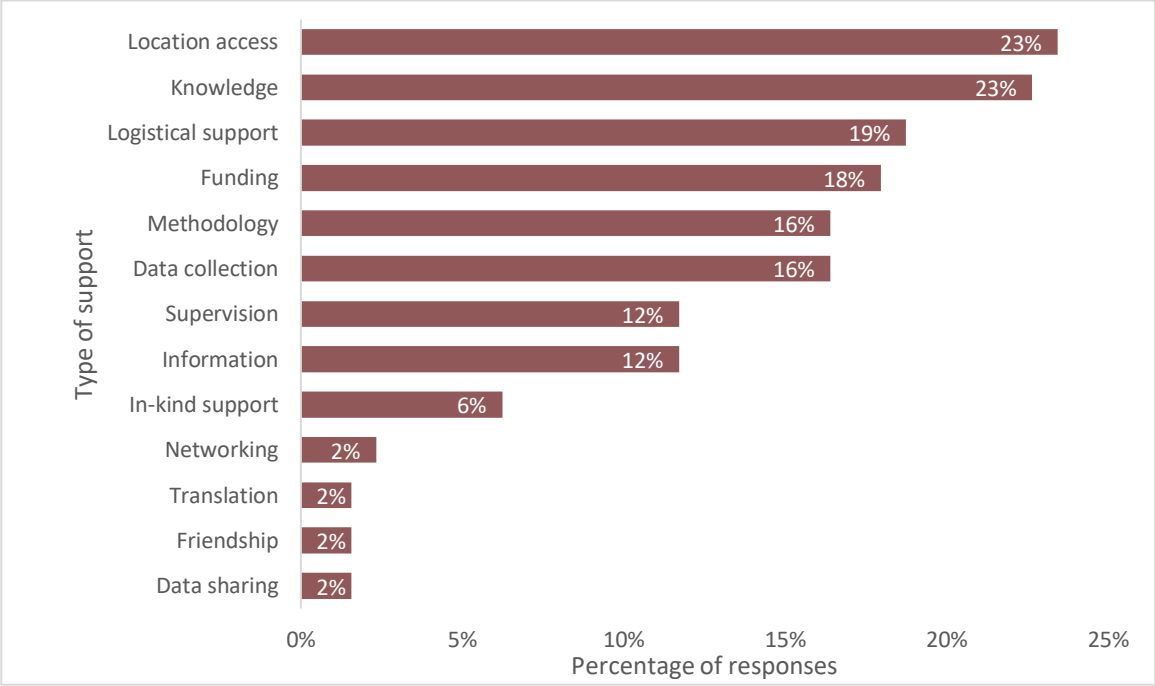


Figure 5-21 Types of support provided to researchers (n=127)

The most common types of support and assistance provided by those who were influential in success of researchers' fieldwork were reported as access to research location (23%), knowledge (23%), and logistical support (19%). Funding was mentioned next (18%), followed by assistance with methodology (16%) and data collection (16%). Examples of each appear in Table 5-12.

Table 5-12 Examples of types of support to researchers

Type of support	Examples [relevant respondent appears in brackets]
Location access	*"Besides giving me permission to work in their area, they introduced me to the area's geography, gave me insight [as to] information on how they operate, animals they are keeping and willingly offered extra time whenever I needed to further do my studies."* **[Student at Botswana institution]**
Knowledge	*"Our own team, knowledge of the area, strong scientific skills."* **[Professional researcher at Botswana institution]**
Logistical support	*"Botswana veterinary specialists. The success of my fieldwork fell largely on capturing the animals that I worked on, without the assistance of the vets I would not have been able to collar the animals."* **[Student at South African institution]**
Funding	*"My project sponsor facilitated all field costs and my supervisor funded a research assistant. Without this I would not have been able to do the work."* **[Student at South African institution]**
Assistance with methodology	*"They coached me on the qualitative material collection and rapport setting with communities."* **[Student at Botswana institution]**
Data collection	*"Local community members make >80 of our staff and provide essential field expertise (we rely on San trackers for much of our data)."* **[Professional researcher in NGO]**
Supervision	*"Without a supervisor and other researchers to talk to my study design would have been weaker."* **[Student at university outside Africa]**
Information	*"The willingness of tourism operators to be interviewed and divulge what could be seen as commercially sensitive information was critical to the success of the fieldwork for this project."* **[Professional researcher in NGO]**
In-kind support	"*They provided access to their concession areas and flew me to them on occasion. I would have also conducted the*

Type of support	Examples [relevant respondent appears in brackets]
	study in Moremi GR, but I would have had to pay entrance fees, and that was beyond my budget." **[Professional researcher from institution outside Africa]**
Networking	*"They were very cooperative and helped to establish further contacts and information about other groups that could be useful."* **[Student at university outside Africa]**
Translation	*"I would not have been able to conduct my research without the help of incredible research assistants who were members of the communities I was working in--they helped me navigate my way through villages, they translated for me, and provided all around incredible support and assistance to me."* **[Student at university outside Africa]**
Friendship	*"Me and volunteers (mainly friends), my family for logistics, the assistant I hired***."[Student at university outside Africa]**
Data sharing	*"Collaborating and pooling data to get the bigger picture for large carnivores in Botswana made it possible to get decent coverage for large parts of Botswana."* **[Professional researcher in the private sector]**

A common form of indirect interaction is researchers' use of information and data collected by others. This often takes place before fieldwork, to ensure that new investigations take existing knowledge into account, but can also happen in the field, as new contacts are made and relevant knowledge about local conditions is exchanged. The re-use of locally produced data and research products should be an indicator of potential relevance of the new research to potential users.

Respondents were asked if they had used data collected by others to support their research under the permit. Overall, 51% of the 124 respondents reported that they had used others' data. Their responses were analysed to learn if this interaction was related to the researchers' perception of use of their research (Figure 5-22).

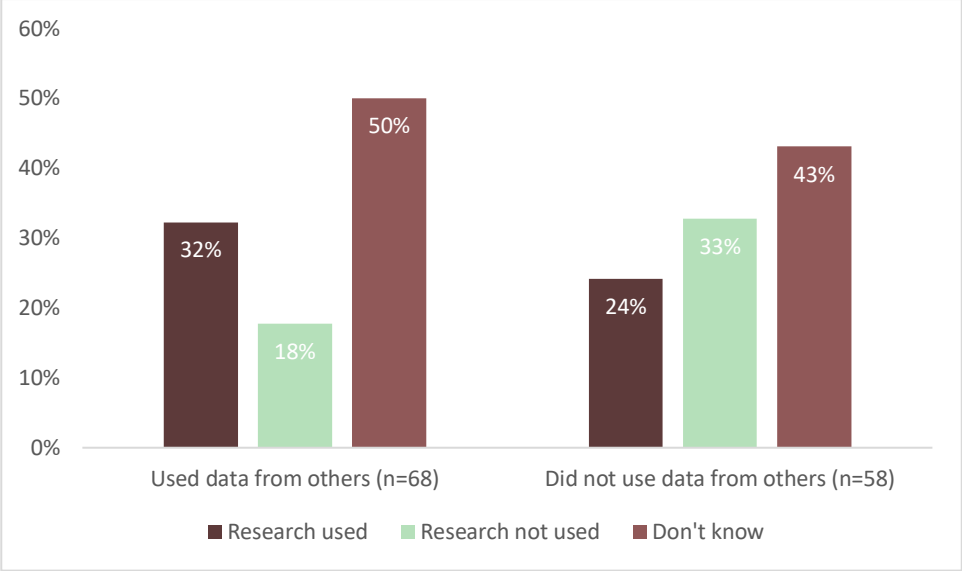


Figure 5-22 Use of others' raw data by perception of use

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Of the 68 respondents who used data from others, 32% said that their research had been put to use. Fifty percent of those who used others' raw data were those who reported that they were uncertain as to whether their research findings had been used. Eighteen percent of the respondents who used others' raw data were those who did not believe their research had been put to use.

Respondents were asked to indicate the external sources of the raw data they had reused, allowing them to choose more than one. Four sources (DWNP Problem Animal Control unit, DWNP Research Division, independent researcher, and Global Biodiversity Information Facility [GBIF]) were provided, and respondents were able to add more sources in an open-ended response. Responses to the open-ended question resulted in 31 additional sources. Some changes were necessary to enable coding. Both DWNP options were changed to government. GBIF was incorporated under international source. The relevant free responses were grouped into the following four categories for analysis:

- Government (including government-funded research bodies) such as Government of Botswana Problem Animal Control (PAC) unit, Botswana National Museum, Department of Forestry and Range Resources, Statistics Botswana
- Independent Researcher (Researchers not necessarily employed by, or affiliated with an institution, whose data was considered their own)
- International Source (Globally available platforms) such as the GBIF, United States Geological Survey)

- Local NGO (Botswana-based organisation) such as Cheetah Conservation Botswana, Botswana Predator Conservation Trust.

Figure 5-23 illustrates the contribution of these sources.

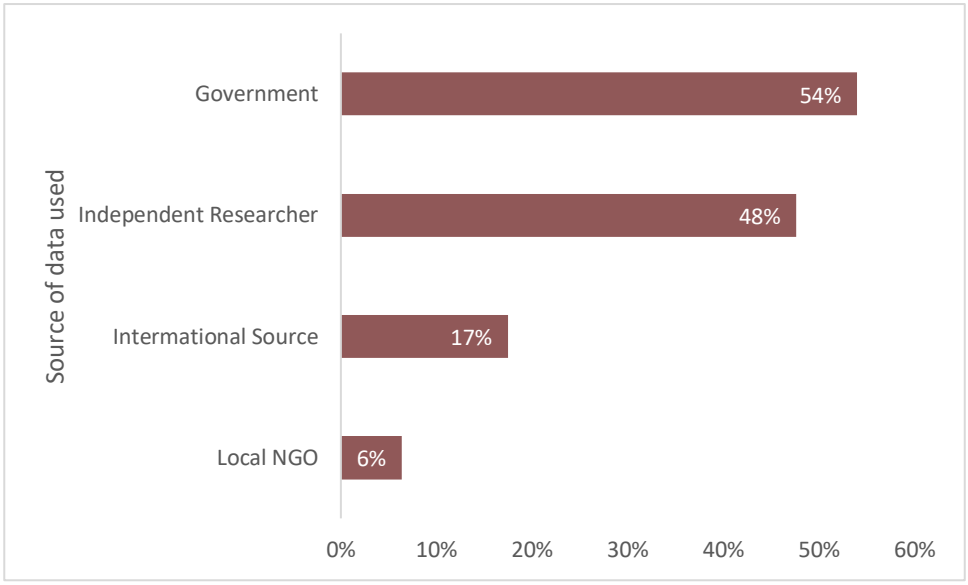


Figure 5-23 Source of raw data used (n=63)

Government sources were most commonly mentioned (54%), followed by independent researchers (48%) who shared their own data.

Re-use of raw data from other sources might indicate a degree of relevance of the current research to what had been done before. In other words, existing interest in this data might point to the likelihood of the current research also being of interest to the stakeholders who were the source of the re-used data. Was there a relationship between the source of raw data and researchers' perception of use? Figure 5-24 cross-tabulates the source of raw data with the respondents' perception of use.

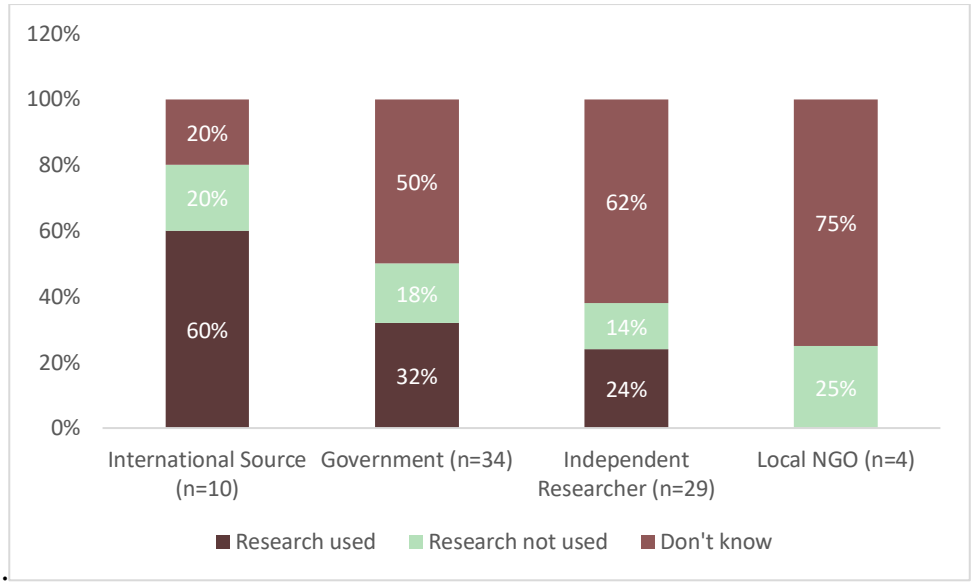


Figure 5-24 Source of raw data used by perception of use

Cross-tabulating survey responses about the sources of raw data with researchers' perception of use indicates that those who used data from an international source reported most that their data had been used (60%). Of those who reported use of government data, more (32%) perceived that their research had been used than not (18%), but half (50%) responded that they did not know if their research had been used. Of those who used data from independent researchers, most (62%) said that they did not know if their research had been used, but those who perceived use of their research (25%) outnumbered those who believed that there had been no use (14%). Those who used NGO data did not perceive any use, with 75% claiming that they did not know.

Sixty-three respondents reported use of others' data. For the 34 researchers who reported using government data, most commonly used were aerial census (15 responses) and PAC data (14 responses).

Data most used from sources other than the DWNP included ground-level wildlife counts (18%), and climate data from weather stations and remote sensing sources (25%).

Sharing of data takes place in more than one direction – using the data shared by others and sharing one's own data for use by others. Section 5.4.3.1 addressed the first of these. This section now speaks to the second.

> *"[Name of NGO] has carried out several spoor surveys to provide population and distribution data for carnivores. 2012 in the CKGR-KTP area in 2013, the CKGR in 2014. Collaborating with [names of other NGOs], DWNP. Each contributes transport, etc. There is huge demand for the data. We give it to government and to others who ask but don't publish it. We also publish articles based on the data."* **[NGO manager (RP018)]**

Sharing of collected data implies that there is an understanding that the data are potentially useful to other stakeholders. Data about wildlife behaviour and populations in Botswana can be used in management, as well as to support other research. Interactions that take place between researchers and potential users as part of the sharing process can be direct – as in the case of a researcher, following a conversation, giving data on a portable drive to another researcher – or indirect, as when data deposited in an online repository is used by another researcher.

Respondents were asked with whom they had shared their raw data collected during fieldwork, and to identify the trigger, or motivation, for the sharing. Six entities for sharing were provided, of which one was an *Other* category. Respondents could indicate more than one entity. For each entity, the respondent had to select the trigger from a dropdown list, comprising five categories:

- direct request
- institutional policy
- personal preference
- publications policy
- other.

A comment box was provided to elaborate on the 'other' entity but also to provide any additional explanations.

Ninety-seven (74%) responded that they did share data with others, indicating that sharing or exchange of raw data among researchers and stakeholders, including institutional stakeholders, was common. Figure 5-25 shows, for each entity, the trigger that resulted in the sharing.

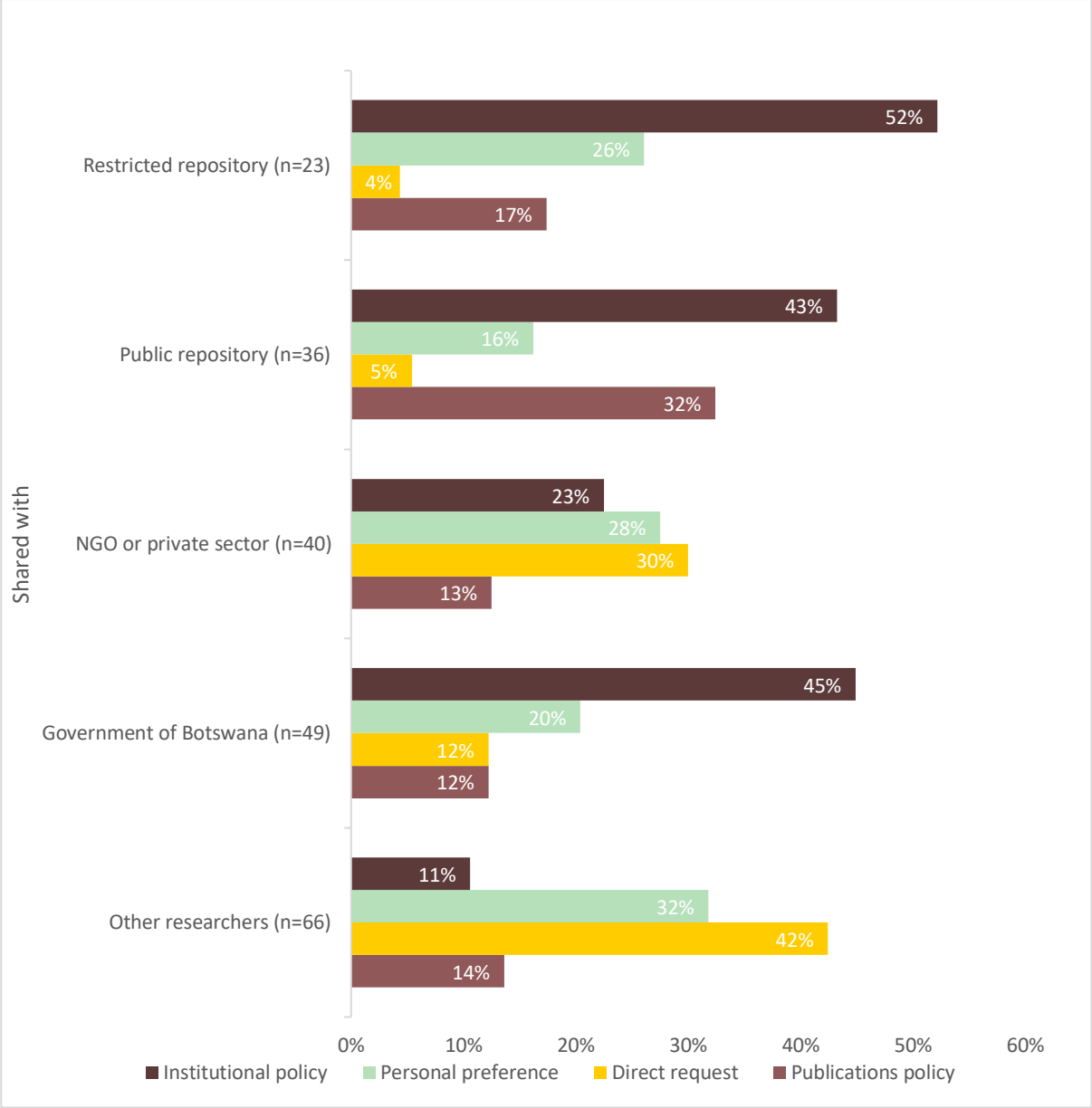


Figure 5-25 Researchers' sharing of their raw data by trigger

The trigger for sharing varied, but institutional policies appeared to have motivated more sharing across all stakeholder groups (45% to government, and up to 52% for repositories). Researchers' personal preference also accounted for researchers' sharing of their data across all categories of stakeholder, mostly in the case of other researchers (42%). Direct requests for data were the most common reason for sharing with other researchers. For sharing with NGOs and private sector stakeholders, the triggers varied more. Several respondents reported sharing of their data with international services such as the *IUCN Red List* and *iNaturalist*.

Figure 5-26 looks at whether there was a relationship between sharing of researchers' raw data and perception of research use.

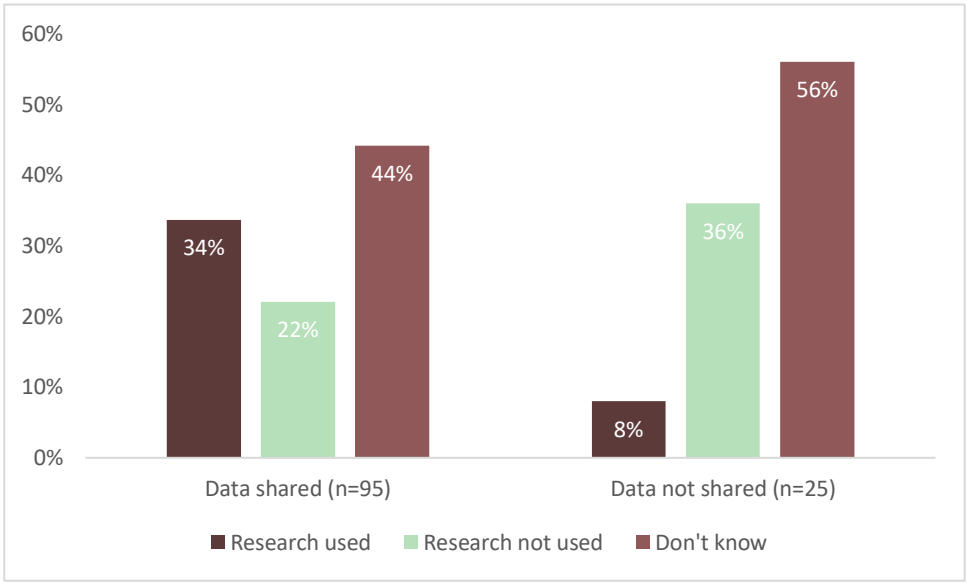


Figure 5-26 Sharing of researchers' raw data and perception of research use

The following statistically significant difference ($p<0.05$) was observed, based on the Bonferroni test for comparison of proportions: "Data shared" (34% research used) > "Data not shared" (8% research used).

Thirty-four per cent of those who shared their own data believed that their research had been used, as compared with only 8% of those who did not share their data.

Respondents were also asked if they were aware that the raw data they had shared had been re-used, and were asked to describe the re-use in an open-ended comments response. Figure 5-27 shows a breakdown of analysis of their responses.

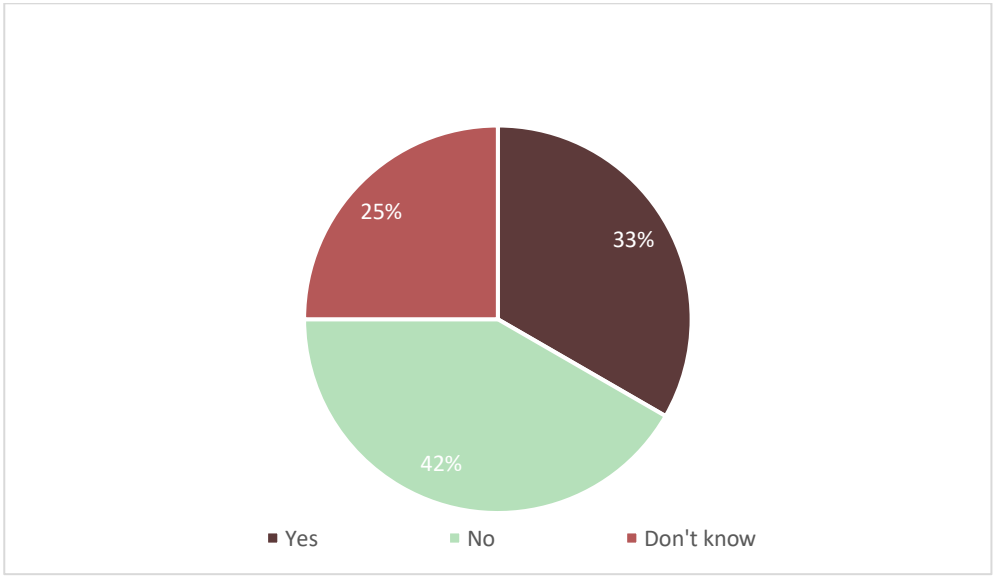


Figure 5-27 Researchers' perception of re-use of their data (n=120)

There were 120 responses to this question. Forty (33%) respondents indicated that they knew their data had been reused, and there were 61 comments (some who responded that their data had not been re-used, also provided a comment, e.g. *"My work has been cited in papers but the raw work hasn't been used to my knowledge." "I have never received any request for the raw data."*

There were 40 references to specific user types in the open-ended responses, and 54 references to types of use. Based on the content of the open-ended responses, six codes indicating the users of the data and seven codes indicating the purpose of its use were developed and applied. Figure 5-28 shows who used the data.

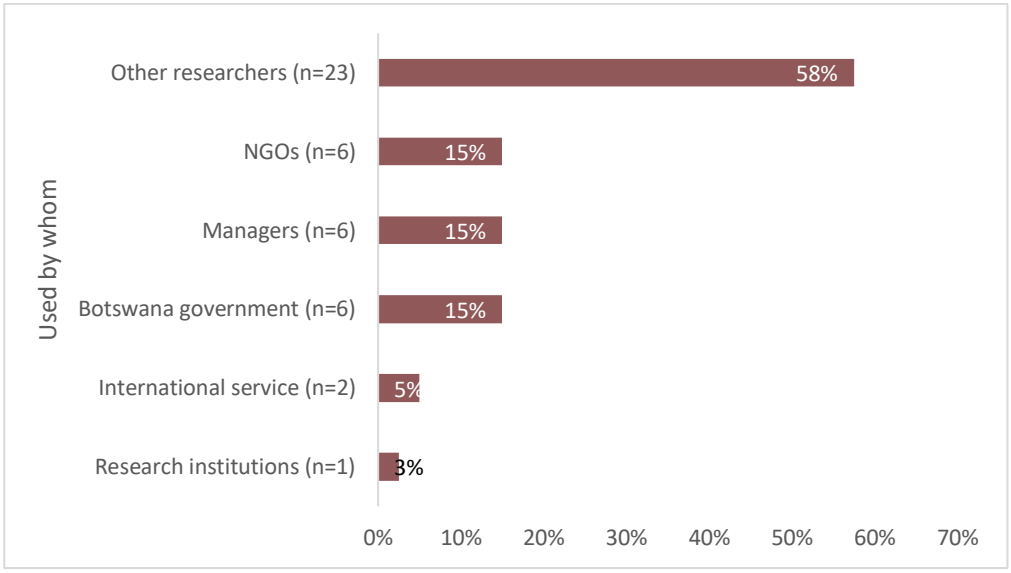


Figure 5-28 Stakeholders reusing researchers' raw data (n=40)

Most re-use reported was by other researchers (58%), as shown in Figure 5-29.

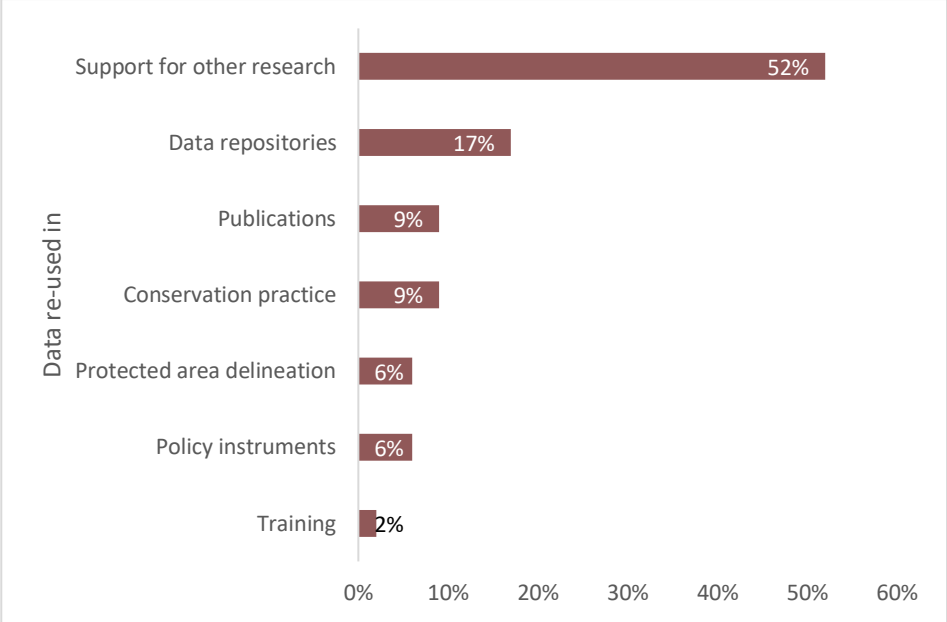


Figure 5-29 Types of re-use of researchers' data (n=54)

Respondents sometimes reported more than one type of use of their data. By far, the most frequent type of use reported was to support further research (52%). Some examples of the types of re-use are provided in Table 5-13.

Table 5-13 Examples of re-use of researchers' data

Support for other research	*"A PhD student in Khutse Game Reserve is currently working on a comparative study and has my raw data for this."*[Student at institution outside Africa] *"Recordings were used during playback experiments elsewhere to test for a 'stranger' effect."* **[Student at institution outside Africa]**
Data repositories	*"Some of the data is currently being used to update the IUCN Red List status for Nile crocodiles in Africa."* **[Professional researcher at Botswana institution in the private sector]**
Conservation practice	*"My data on elephant pathways and drivers of crop raiding has been incorporated into Land Use planning models and has influenced the establishment of 13 elephant corridors."* **[Student at institution outside Africa]** *"Lion surveys from 1995 to 2000 were used by DWNP to guide quota setting for lions."* **[Professional researcher in the private sector]**
Publications	*"For use in presence surveys of large carnivores for publication."* **[Student at South African institution]**
Policy instruments	*"Artificial waterhole impact data was used to set Limits of Acceptable Change for the Chobe NP management plan."* **[Professional researcher in the private sector]**

Protected area delineation	*"The DWNP and Ministry have used my data to help define the boundaries of and establish the laws/management terms and conditions of the … sanctuary."* **[Student at institution outside Africa]**
Training	*"Our voucher specimens become part of the National Herbarium, other specimens are used in 3 teaching herbaria, plant lists provided to safari operators are used as management and training tools."* **[NGO researchers]**

It is worthwhile to ask if there was a relationship between the re-use of researchers' data and perception of overall research use. Figure 5-30 shows the results of this comparison.

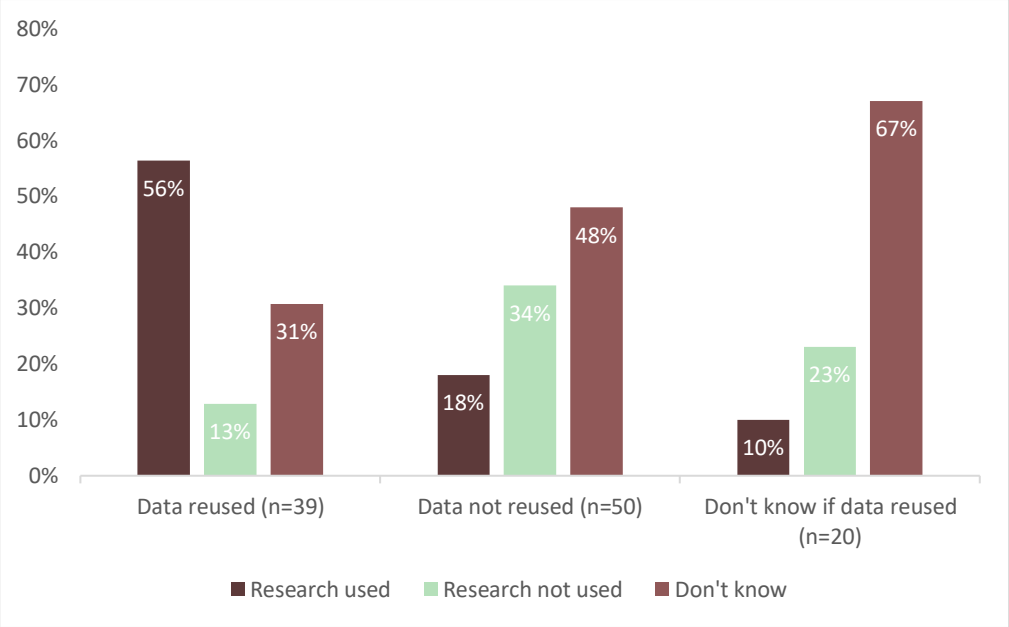


Figure 5-30 Re-use of data by perception of research use

The following statistically significant differences ($p<0.05$) were observed, based on the Bonferroni test for comparison of proportions:
"Data reused" (56% research used) > "Data not reused" (18% research used)
"Data reused" (56% research used) > "Don't know if data reused" (10% research used)
"Don't know if data reused" (67% don't know) > "Data reused" (31% don't know).

The comparison shows that, for those who reported that their data was re-used by others, those who also perceived a contribution outcome for their overall research had the highest percentage (56% as opposed to 13% for those who perceived no contribution). Only 18% of those who indicated that their data had not been re-used reported use of their overall research findings, compared to 34% and 48% of those who indicated no use, or who didn't know.

5.5.3 Interactions with stakeholders in writing up and sharing of analysed results

The process of writing up research findings can provide opportunities to provide additional context that makes the findings more clearly relevant to application, and can remind a researcher of the stakeholders who could put their work to use in policy or practice.

Sharing of analysed results is perhaps the most predictable interaction that researchers have with stakeholders, since it can be viewed as a last step in the research process before wider publication and dissemination. At this stage it is possible for stakeholders to think again about the relevance of the research findings. This may include looking to see if local context has been addressed through reference to existing, documented, knowledge.

Official government documents, including commissioned consultancy studies, are especially important in gaining understanding of management concerns and priorities. Respondents were asked if they used Botswana government documents when writing up their research. Five document types were provided, and respondents were given the option to identify other types. Combining the responses to the structured question and the free response question resulted in nine categories of types of documents used.

Of the 121 who answered this question, 72 (57%) responded that they had used government documents when writing up their research. These indicated that they had used the types of document shown in Figure 5-31.

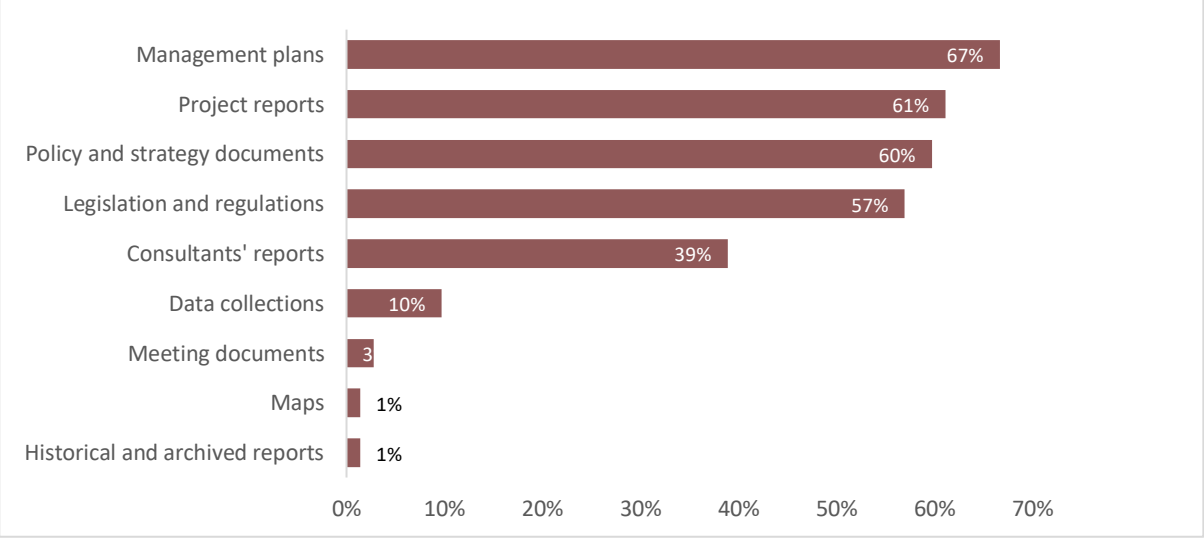


Figure 5-31 Use of government documents (n=72)

Management plans were most used, followed closely by project reports, policy documents and legislation. Management plans are produced for government, to guide conservation and development of protected areas. They usually provide detailed descriptions of the resource, lists of relevant references to previous research and policy documents, identification of research gaps, and recommendations related to resource use: a potentially rich source of local information for those carrying out new research. Official management plans and legislation, unlike many other Botswana government documents[27], are also usually accessible to a wide audience.

Was there, then, a relationship between the use of government documents and perception of research use? Figure 5-32 illustrates this relationship.

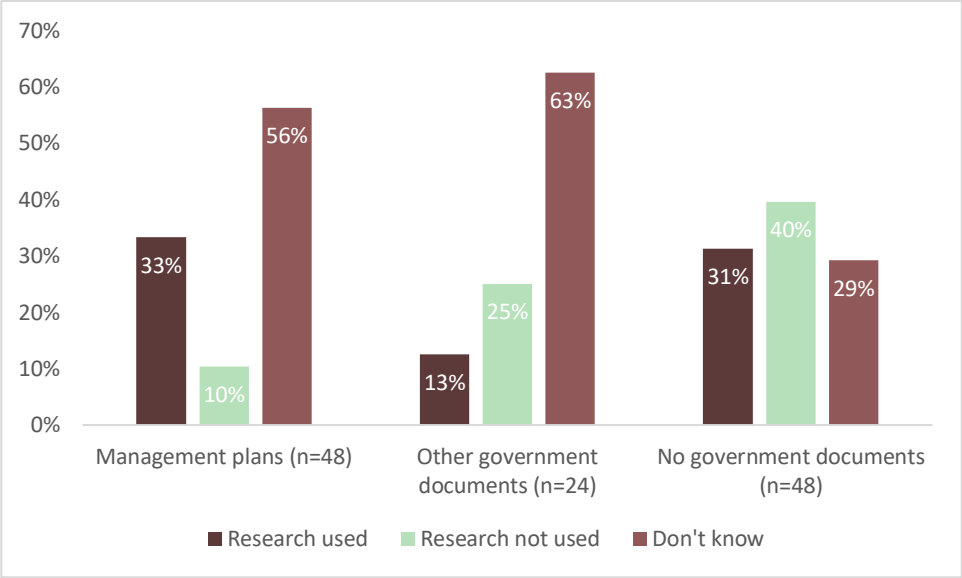


Figure 5-32 Use of government documents by perceived research use (n=120)

The following statistically significant differences ($p<0.05$) were observed, based on the Bonferroni test for comparison of proportions:
"Management plans" (56% don't know) > "No government documents" (29% don't know)
"Other government documents" (63% don't know) > "No government documents" (29% don't know)
"No government documents" (40% research not used) > "Management plans" (10% research not used).

Those researchers who indicated that they had used managements plans from government were least likely to report non-use of their research, compared to researchers who had not relied on any government documents (10% versus 40%). Further analyses revealed that the government documents used most by those who indicated use of their research were management plans (84%)

[27] Botswana's Department of Environmental Affairs (DEA) established an online repository of official documents from its parent ministry's departments in 2009. The repository functioned for several years, but went offline for refurbishment and, until the time of writing, its content has not been available.

and project reports as part of other government documents (79%). Both these sets of documents are closely related to planned and ongoing activity.

Survey respondents were asked with whom in Botswana they had shared their analysed results on completion of their fieldwork. Respondents were offered five choices and the opportunity, through an open-ended *Other* choice, to provide additional categories. Selection of more than one was permitted. In analysis of the responses, three additional categories were coded from the open responses. Figure 5-33 illustrates this.

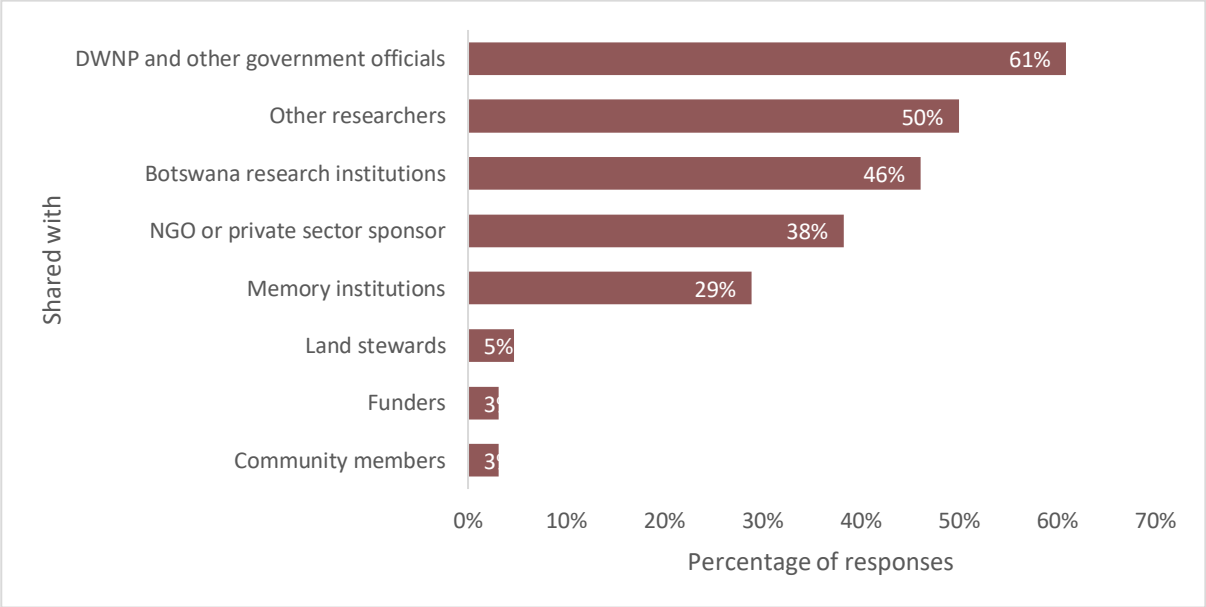


Figure 5-33 Sharing of analysed results (n=128)

Government officials, including DWNP, were the most common recipients of research findings (61%), followed by other researchers (50%) and Botswana research institutions (46%). Fewer than 30% reported sharing with memory institutions, such as libraries and archives, which are responsible for long-term preservation and access.

Figure 5-34 show the results of an analysis of whether there was a relationship between the recipients of shared findings and the researchers' perception of use.

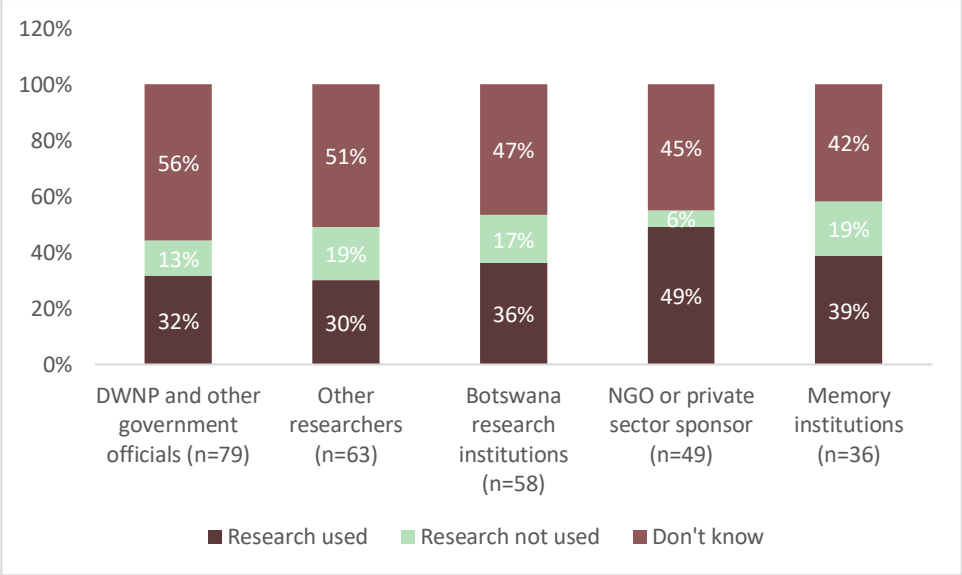


Figure 5-34 Sharing of analysed results by perception of use

Forty-nine percent of those survey respondents who shared their results with an NGO or private sector sponsor reported that their research had been put to use. Corresponding percentages of research use for the other recipients of shared findings ranged between 30% and 39%.

Of the 79 respondents who shared with DWNP, 32% reported research use, 13% reported no use, and 56% did not know.

Irrespective of the category of recipient of shared findings, the instances of research use are consistently higher than the instances of no research use.

Their priority recipients for sharing also differed: while the top priority for those who believed their research was used was sharing with NGOs, for those with a negative perception of their research use, other researchers and memory institutions were most important. There was not much difference in the responses of those who claimed they were uncertain about their findings getting into use: they appear to have shared their findings in the same amount across all categories of stakeholder – slightly more with government officials.

Sharing of final reports, theses and journal articles indirectly, or making direct presentations that summarise the findings of research, are interactions that can reach stakeholders beyond academia. Respondents were also asked about the methods used to share their analysed results with people and institutions in Botswana. Nine options were supplied, and, again, additional categories were allowed through an open-ended *Other* choice. Respondents were allowed to choose more than one category. When analysed, these responses resulted in 12 categories of sharing methods. Figure 5-35 shows these methods.

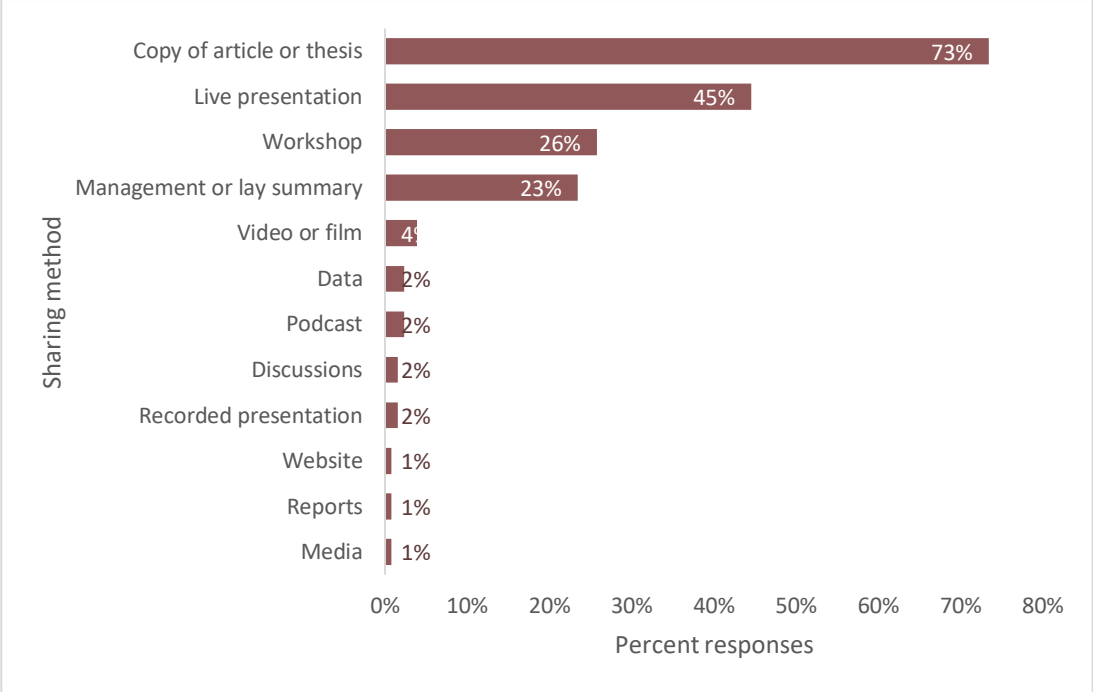


Figure 5-35 Methods of sharing of analysed results (n=112)

For the most part, researchers shared their analysed results in the form of a copy of a thesis or publication (73%). Close to half (45%) of those responding had made live presentations of their findings, and a quarter reported that they had shared their results at a workshop or in the form of a lay summary. Very few reported use of communications channels other than these.

Figure 5-36 looks at whether there was a relationship between the method used to share the researchers' findings and their perception of use.

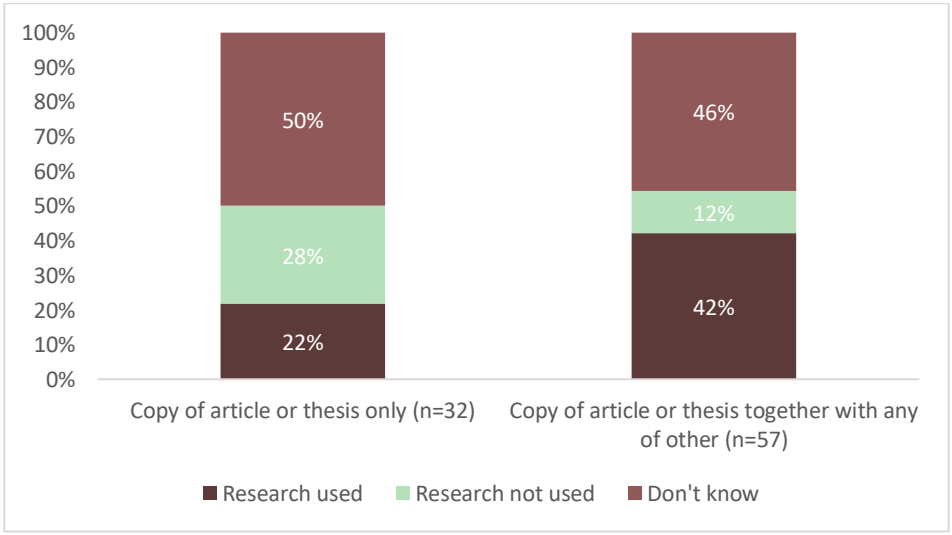


Figure 5-36 Method of sharing analysed results by perception of use

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Respondents who had indicated that their research had been put to use shared their findings with Botswana stakeholders by way of the four most common formats. Of the 32 respondents who shared a copy of article or thesis only, 22% reported that their research had been put to use. Of the 57 researchers who shared their work through a copy of an article or thesis and at least one other format, 42% reported that their reseach had been used.

Interactions that involve sharing of analysed research results can be both direct and indirect, and reach a cross-section of stakeholder audiences. Research carried out in the field can be communicated indirectly following the end of a field trip, or after completion of a thesis, article or book – a process that can take months or years.

Survey respondents were also asked which formats they had used to share or disseminate their analysed research anywhere and anytime, providing a selection of 11 possible submission formats and the option of providing more through an open-ended *Other* choice. Scholarly literature was not included among the original choices as the intention was to discover which ways the research findings were disseminated to a broader audience. Respondents were allowed more than one selection. Responses were coded into the 14 categories shown in Figure 5-37, one of which was scholarly literature.

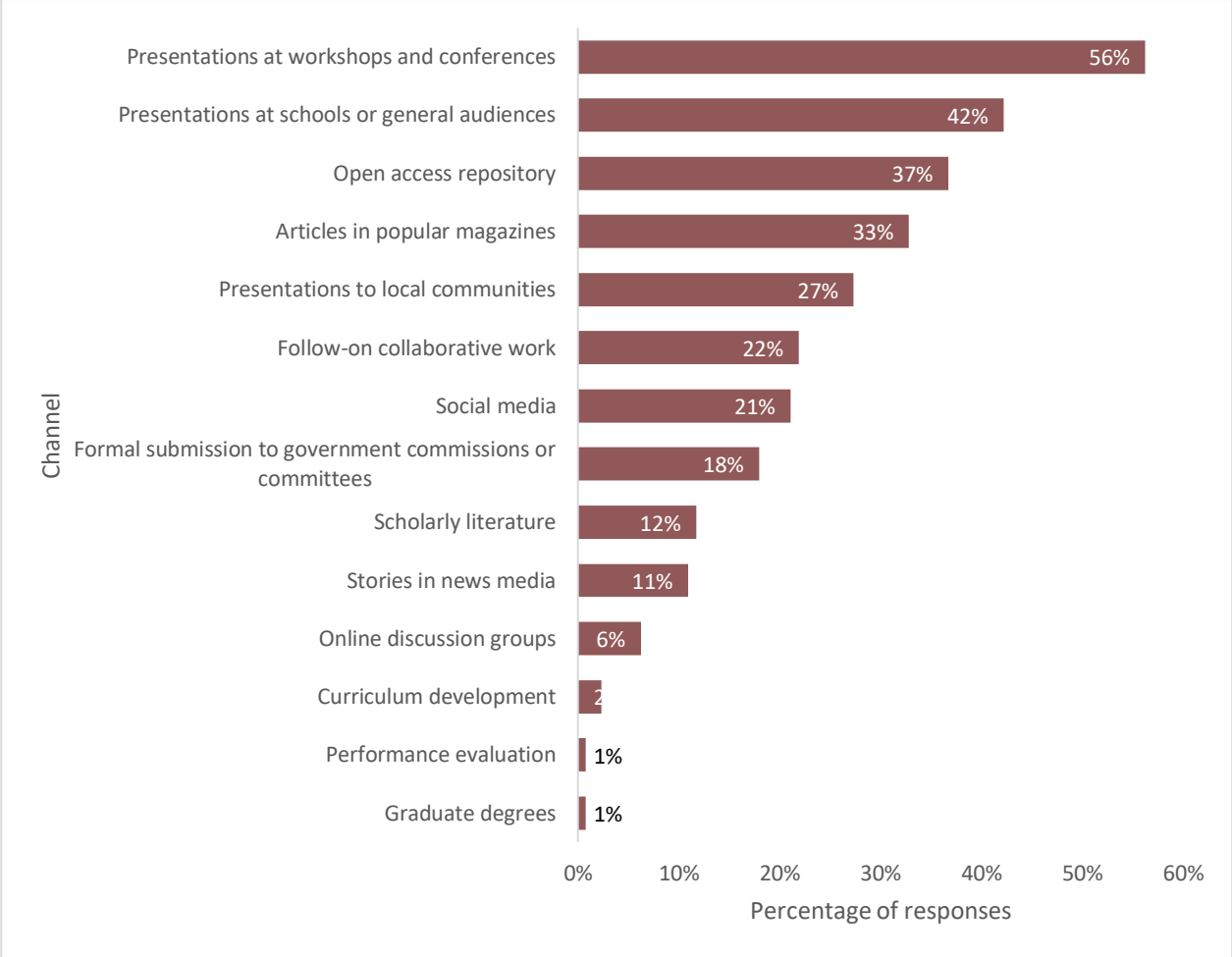


Figure 5-37 Formats used to disseminate research (n=128)

The relationship between the formats most used to disseminate the research results, and the researchers' perception of use of the research was explored, using only those format categories with at least 10 responses. These are shown in Figure 5-38.

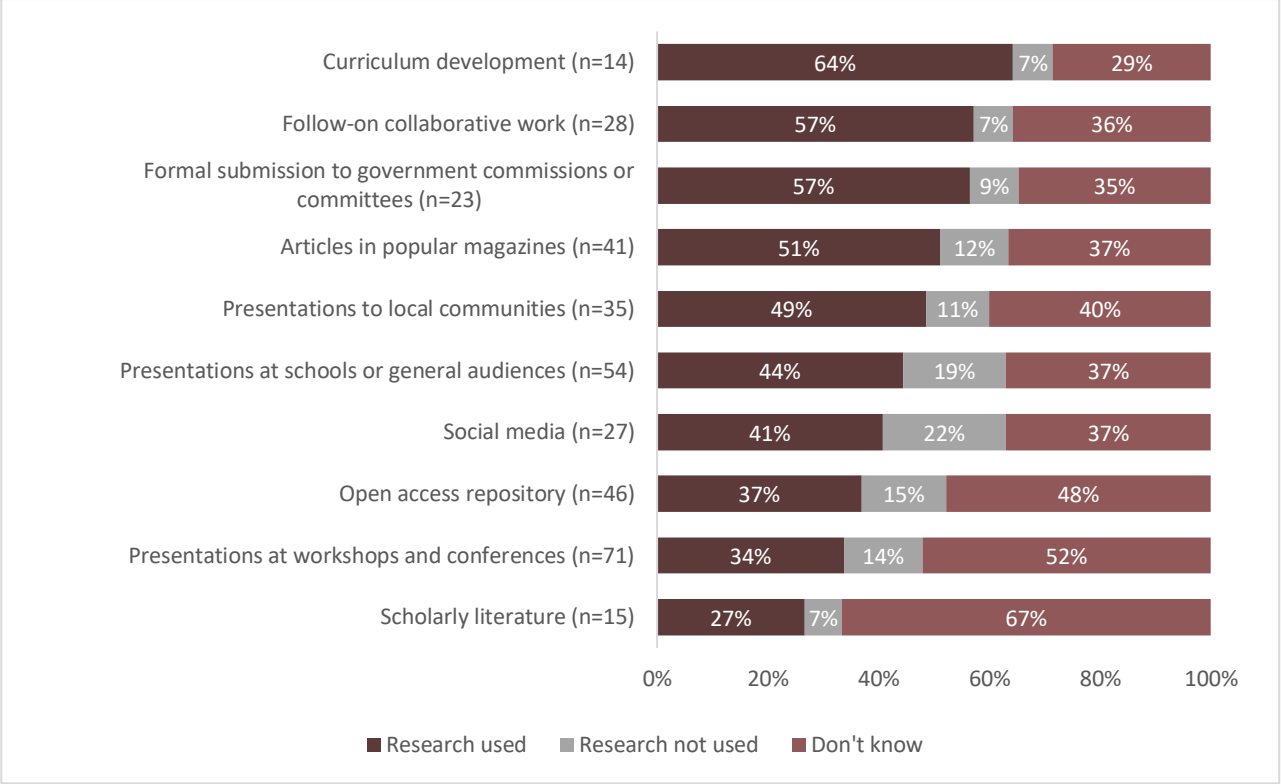


Figure 5-38 Channel for sharing of findings by perception of use

The highest percentages of use are assocated with curriculum development and follow-up collaborative work. Specifcally, 64% of the 14 respondents who shared findings as part of curriculum development, reported that their research had been put to use.

Presentations were the most used method for sharing analysed results, and the popularity of this channel among researchers was also evident when respondents were asked, for the entire cycle of their research activity in Botswana – from planning to dissemination – what they considered the most effective channel for sharing their work. Responses to this follow-up question were completely open-ended. Although the intention was to elicit one answer per respondent, some respondents pointed out that the type of channel could vary, depending on the audience. From 91 responses, 141 mentions of channels were made. These were coded into the 11 categories shown in Figure 5-39.

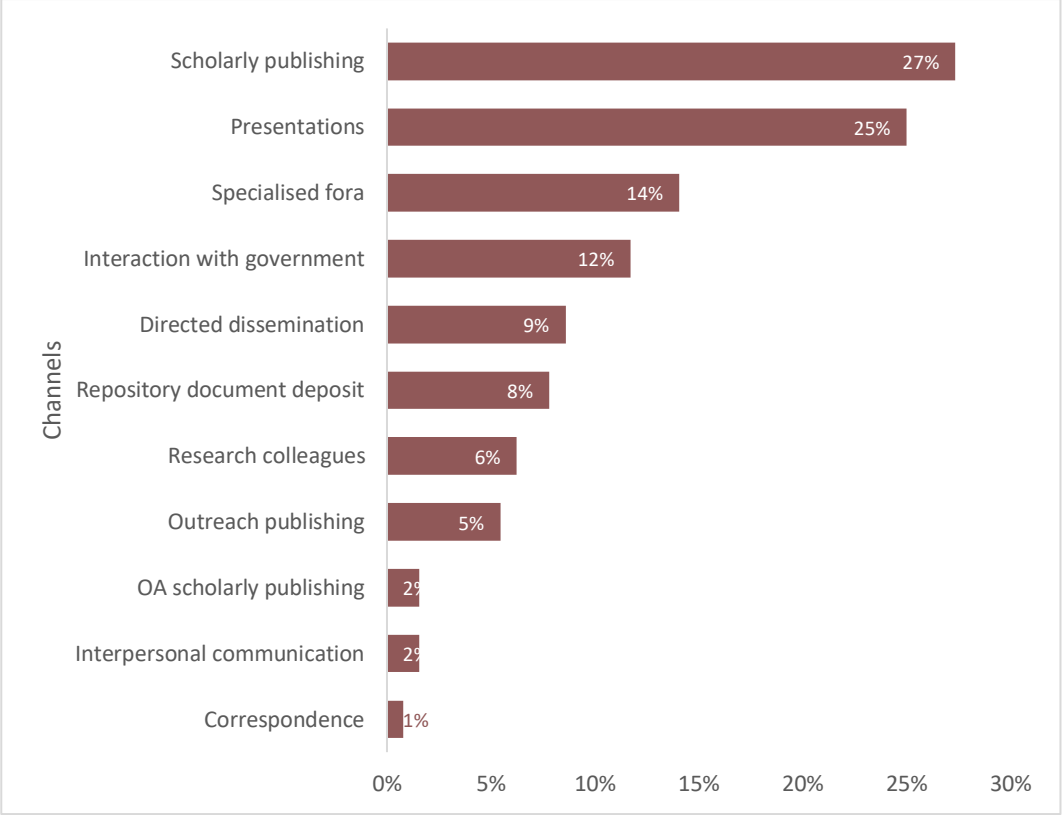


Figure 5-39 Most effective channels for sharing (n=91)

The greatest number of responses to this question indicated that scholarly publishing was considered most effective, possibly indicating the importance these researchers place on what they consider their core business: production of new scientific knowledge. Some respondents stated clearly that only other scientists could understand their research well enough to make a difference, or acknowledged what they felt was a failure to address the need to communicate with other stakeholders. Examples of this are shown in Table 5-14.

Table 5-14 Scholarly publishing as most effective channel

Most effective channel	Examples
Scholarly publishing	*"Discussions with colleagues. The gap in education and culture to general public and officials was too wide to make communications effective."* **[Professional research in a Botswana university]**
	"For scientists engaged in research, the most effective channel is through publication in peer-reviewed science journals." **[Professional researcher in a university outside Africa]**
	"I should have done presentation to local land managers and NGOs. But I have only published peer reviewed

Most effective channel	Examples
	articles." **[Professional researcher in another African country]**

Presentations at workshops and community meetings were acknowledged as an effective method by most, but could indicate a belief that sharing research with a broader range of stakeholders was important. Some examples are shown in Table 5-15.

Table 5-15 Presentations to other stakeholders as most effective channel

Most effective channel	Examples
Presentations to other stakeholders	*"Presentations at different forums such as workshops since other researchers and people of different calibres can have direct feedback to my research."* **[Student at a Botswana university]**
	"Live presentations (to both government audiences, local communities and then back home to academic audiences)." **[Student at a university outside Africa]**
	"It depends on the audience. In the case of sharing findings with communities, I think kgotla meetings were the most effective. In the case of sharing with other researchers and colleagues in Botswana, I think published articles were the most effective. I would like to think the summary I created for government was also useful, but I never received feedback or confirmation that it was received." **[Student at a university outside Africa]**

Some researchers found that more formal, targeted engagements related to specific problem solving could reach the most appropriate potential users of the research. Some examples of this are shown in Table 5-16.

Table 5-16 Targeted engagements as most effective channel

Most effective channel	Examples
Targeted formal engagements	*"Local reports to area residents and leadership at multiple phases in project; in larger sense, reports of training to DWNP incredibly helpful in providing a*

Most effective channel	Examples
	means to give back in-country." **[Professional researcher in a university outside Africa]**
	"Conferences and development of management plans through consultancies." [**Professional researcher in a Botswana university]**
	"I am not sure, I would say direct communication to … community and Maun DWNP office + dissemination to other NGOs + researchers working on Human-Wildlife Conflicts." [**Professional researcher in an NGO]**
	"Research conducted informed the management of elephants across three countries, thus most effective channels were direct communication with government, reserve management, and TFCA trilateral committee." **[Student at a South African university]**

When analysed with corresponding responses about perception of use, as in Figure 5-40, those who indicated targeted formal engagements for sharing their research also indicated more use of their research (43%), while those who relied on scholarly publishing and stakeholder presentations for sharing, showed decreasing perception of use (20% and 28%).

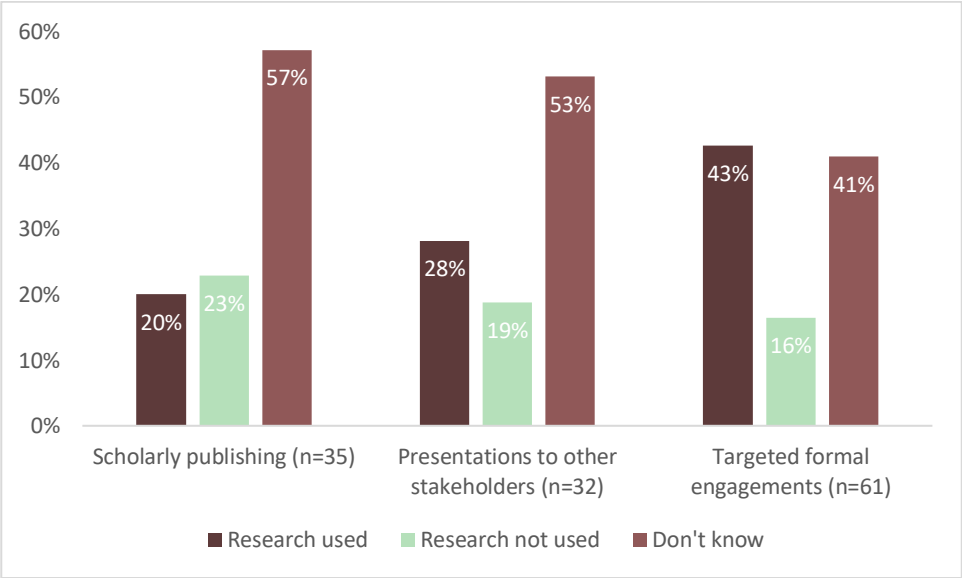


Figure 5-40 Most effective sharing channels and perception of use

Note: The three categories of sharing channels are not mutually exclusive.

Comments, questions, or other forms of follow-up to shared research findings can be considered a productive interaction, in that the findings have been both acknowledged, considered, and, sometimes, acted upon. As the grantor of research permits, it could be expected that the Government of Botswana would recognise completion of the research work carried out and comment on the findings.

Survey respondents were asked whether they had received feedback from the DWNP or other government officials after the results of the research work had been shared.

Twenty-seven percent of those responding to this question indicated that they had received feedback from those government officials with whom they had shared their research findings. Of these researchers who had received feedback, 35% had submitted regular reports to the government during their fieldwork.

Only 20 respondents briefly described the feedback. Their responses can be grouped in six categories:

- Comments and questions (8 responses): *"We had numerous verbal and email comms back from the DWNP often." After giving live presentations, I received feedback in the Q&A session."*
- Indication of awareness of the research findings (7 responses): *"The research report suggested potential action from DWNP in order to reduce Human-Wildlife Conflict in NG32. DWNP received the report and told us they will consider implementing actions. I think this was done after some years within a larger framework including other human-wildlife projects in various areas of Northern Botswana." "The only thing I got was an invitation to a workshop to share my research findings."*
- Discussions (5 responses): *"Discussions with research division staff, directors, ministers to plan ways forward for enhanced lion conservation plans."*
- Recognition of importance (4 responses): *"On training aspects and we developed an increasingly broad yet targeted training agenda and curriculum."*
- Direction (4 responses): *"Following the publication of our first book we were invited to extend the geographical range of our research*." "*Direction on next steps as we have not reached conclusion status*."
- Acknowledgement of receipt (3 responses): *"The official from natural history division extended gratitude for the voucher specimen."*

Substantive interactions included suggestions for further research in Botswana, and invitations to participate in programmes, workshops or policy development related to the topic. Some respondents pointed how direct, in-person interaction facilitated feedback from government officials: *"Feedback is typically received when results are presented in person. We have received very little feedback on written reports."*

5.6 Perceived relevance of research and the relationship with perceptions of use

Relevance of research to potential users is often established at the planning stages and has been identified as an important factor in research uptake. Respondents were asked if they felt their research was relevant, at three degrees and at four geographic levels. Their responses are summarised in Figure 5-41.

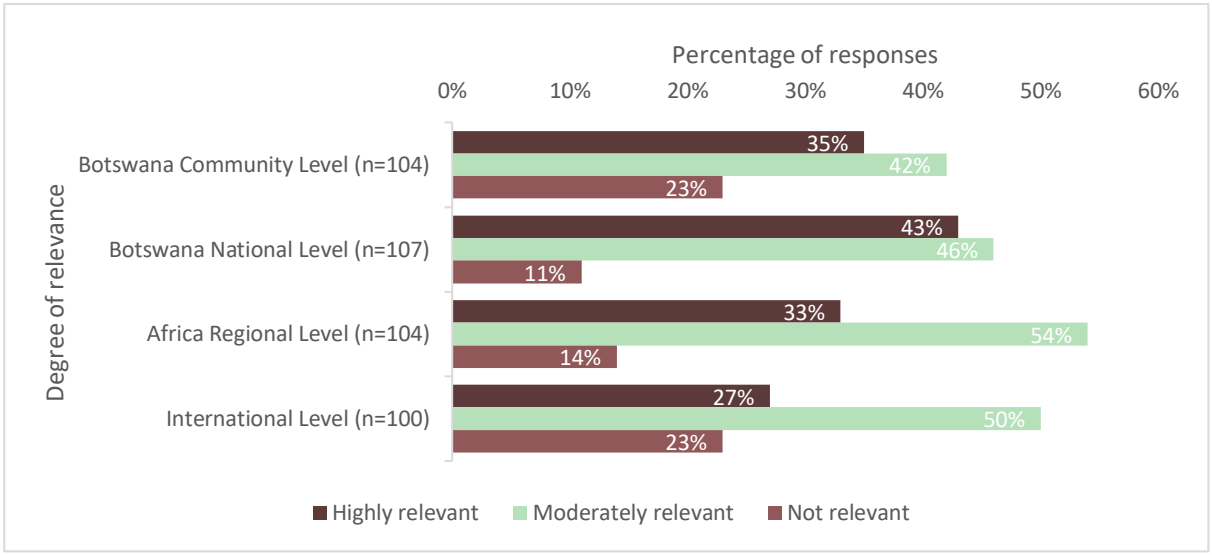


Figure 5-41 Most effective sharing channels and perception of use

The strongest response to this question from those surveyed was that their research was moderately relevant at all four geographic levels, perhaps most at African regional level (54%). Relevance at Botswana national level was judged highly by the most respondents (43%).

When combined with responses about whether the researchers felt their findings had been used, those who perceived a contribution also indicated that their work was relevant at most levels. Those who claimed that they didn't know if their research had been used, also, for the most part, judged their research as relevant at most levels. Those who perceived no contribution outcome indicated more often that their research was not relevant.

Figure 5-42 uses the four geographic levels to compare those who considered their research relevant to those who did not, in relation to their perceptions of use. The 'highly relevant' and 'moderately relevant' categories have been merged.

Geographic codes used in the chart are:

- BW loc = Botswana local level
- BW nat = Botswana national level
- Afr = Africa regional level
- Int = International level.

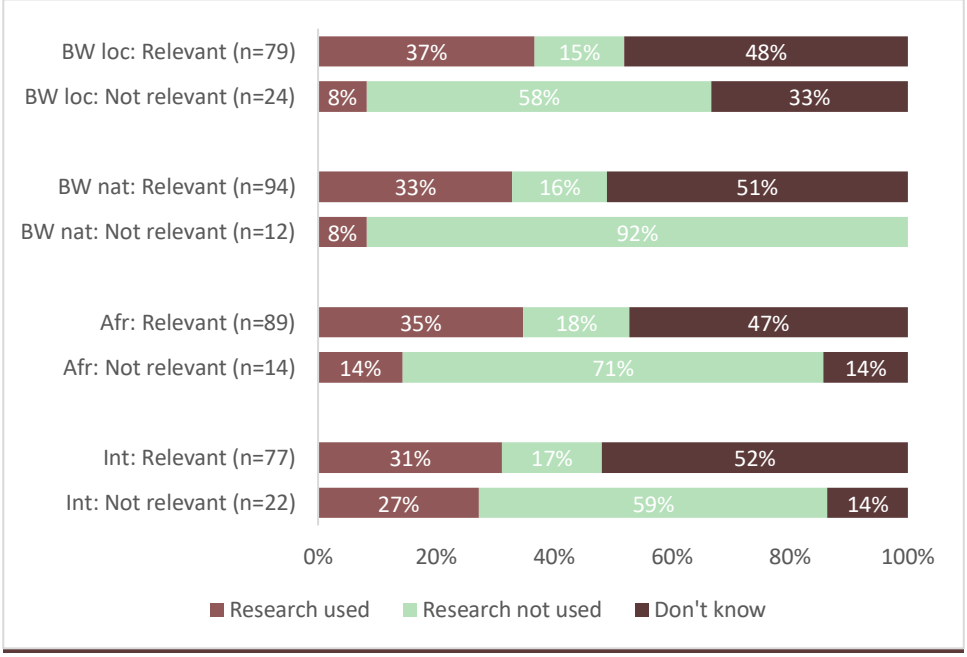


Figure 5-42 Perception of relevance by perception of use

The following statistically significant differences ($p<0.05$) were observed, based on the Bonferroni test for comparison of proportions:
"BW loc: Relevant" (37% research used) > "BW loc: Not relevant" (8% research used)
"BW loc: Not relevant" (58% research not used) > "BW loc: Relevant" (15% research not used)
"BW nat: Not relevant" (92% research not used) > "BW nat: Relevant" (16% research not used)
"Afr: Relevant" (47% don't know) > "Afr: Not relevant" (14% don't know)
"Afr: Not relevant" (71% research not used) > "Afr: Relevant" (18% research not used)
"Int: Relevant" (52% don't know) > "Int: Not relevant" (14% don't know)
"Int: Not relevant" (59% research not used) > "Int: Relevant" (17% research not used).

Those indicating no relevance across the geographic categories also reported the least use of their research, with percentages of research use ranging from 8% to 27%. On the other hand, those indicating relevance across the geographic categories reported higher instances of research use (31% to 37%). Those indicating relevance, however, were also the most unsure if their work had found its way into use (47% to 52%).

It might be assumed that research carried out in a particular geographic location would be considered especially relevant to that location. Figures 5-43 and 5-44 compare respondents' perception of the relevance of their work to Botswana at both national and community levels by the geographic location of their research.

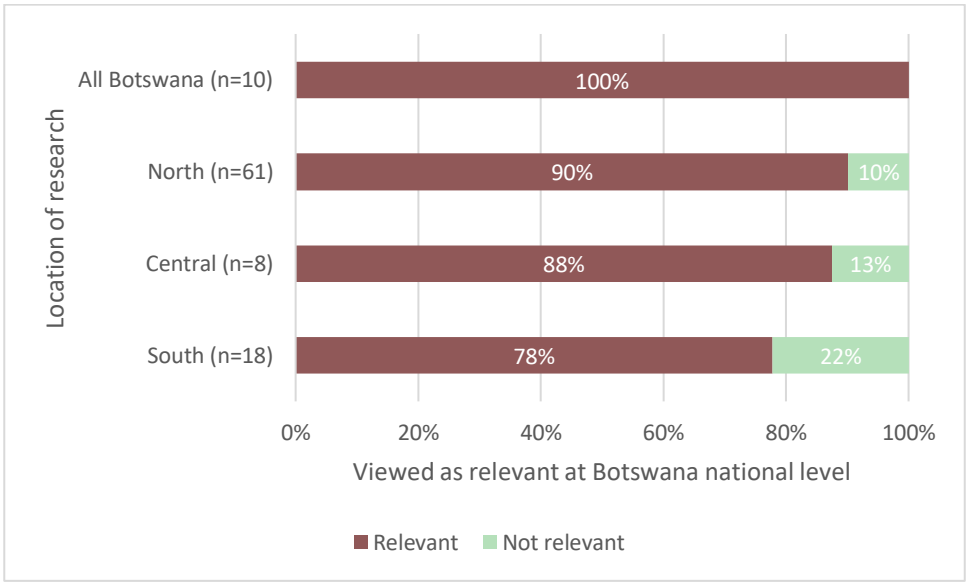


Figure 5-43 Perception of relevance at Botswana national level by location of research

Most respondents felt that their research was relevant to Botswana at the national level, more so for those whose research was carried out in the north (90%) of the country and in Botswana's central region, which includes the Kalahari grasslands (88%).

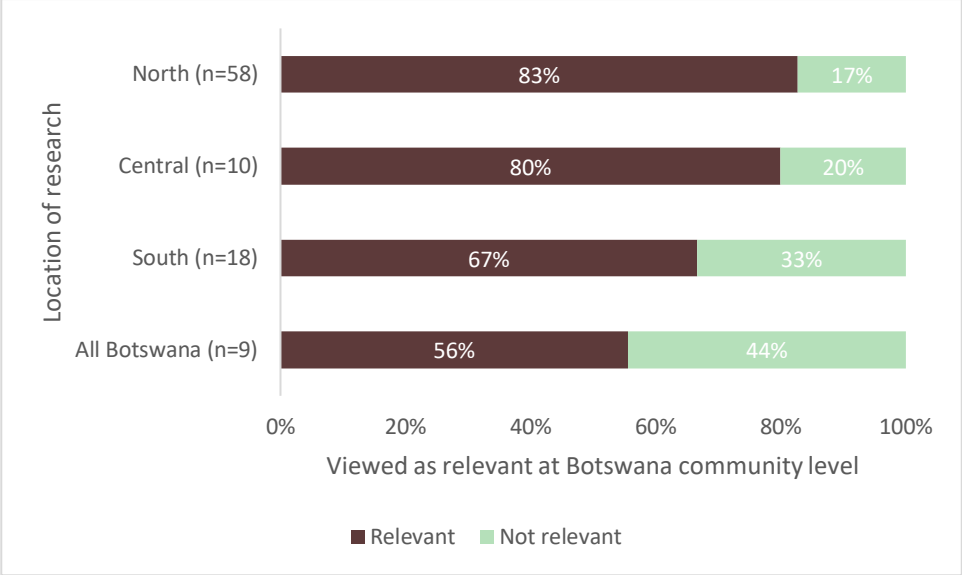


Figure 5-44 Perception of relevance at Botswana community level by location of research

Researchers who carried out their work in Botswana's north (83%) and central region (80%) felt most that their work was relevant at community level, whereas only slightly more than half of respondents (56%) whose research was carried out country-wide believed that their research was relevant to communities.

5.7 Conclusion

The objective of this chapter was to determine if principal investigators who carried out research under Botswana Ministry of Environment, Natural Resources and Conservation permits between 1996 and 2014 engaged in productive interactions that led to uptake of the findings by stakeholders: outcomes that could contribute to improved management of the country's wildlife and natural environment. Aligned with this objective was an attempt to identify the types of interaction that, if incorporated and cultivated within the regulatory research permit process itself, would result in more of these contribution outcomes.

Following the field research 'pipeline', from priority topic identification through to sharing of analysed results, the survey results provide insights as to how the researchers surveyed viewed their interactions with others, perceived the relevance of their work to policy and practice, and judged whether their work was taken up into use.

The survey revealed differences in perception of use among the principal investigators by their institutional affiliation, scientific discipline, and quantity and the types of interactions with stakeholders reported. Most of the respondents said that they did not know if their research had been taken into use. Of those who did perceive that their research was used, researchers in the

private sector and in NGOs more often perceived a contribution outcome, while researchers in institutions perceived little or no contribution outcome. Responses from researchers in the natural sciences showed a pattern of greater confidence in the use of their research than did those from social scientists. Those who perceived a contribution also indicated that their work was relevant at several geographic levels.

The largest gap between researchers who felt that their research had been used and those who did not, or those who did not know, was for those whose motivation was *an observed problem, or a priority identified in the DWNP research strategy or other accepted management policy*.

Analysis of the survey results found that the following interactions identified by research uptake scholarship as contributing to the creation and sharing of new knowledge, its recognition, and application, were evident among northern Botswana wildlife stakeholders and researchers.

5.7.1 Joint priority setting and project planning to ensure relevance of the work to management

Botswana citizens were not only engaged in wildlife-related research, but foreign research permit holders had opportunity for interactions with Botswana researchers – and with that, the networking opportunities with other stakeholders based in Botswana – throughout the research process. Both these conditions allowed for early engagement of local stakeholders in priority setting and planning.

5.7.2 Ongoing knowledge exchange to build trusted relationships

> *"Governments are slow to move. The bigger impact is when you go directly to the end users. Like we did with the fishing disputes resolution for the [name of project]. But you have to make government your partner; otherwise the end users will not trust your recommendations. It gains legitimacy. As a [species specialist], I have always worked closely with [the relevant] officials. It is also important to make the stakeholders a part of the process as early as possible. Implementation, though, is an issue. The government never really adopted some of our work as a strategy. This requires constant reminding and follow-up, which usually doesn't get done."* **[Professional researcher at Botswana university (G008)]**

Most respondents reported interactions with other researchers, government officials and communities, and some with Botswana NGOs. Those researchers who interacted with others indicated higher confidence that their work had been put to use, irrespective of which category of stakeholder was involved. Most common interactions during fieldwork were inclusion in research, and discussions of methodology, most of these with other researchers. Other researchers appear to have been most important in supporting researchers in the field, followed by funders and government officials. The most common types of support and assistance provided by those who

were influential in success of researchers' fieldwork were reported as access to research location, knowledge, and logistical support.

5.7.3 Sharing the knowledge base as it grows, and building capacity across stakeholders

Both survey results and interviews showed evidence of willingness to share data, and to share knowledge with other stakeholders throughout the research process. There was hesitancy, however, in attributing influence beyond the local to these activities.

> *"While government likes what we do, we are much better at interacting locally than we are at influencing central government policy. There is not enough influence trickling up. Our hierarchy is too acceptable by everybody. Those in charge know what is best."* **[Professional researcher at Botswana institution (E015)]**

This observation was echoed by a retired senior government official:

> *"There is more success where people are actually working more and more with local communities and the local stakeholders to get things done, as opposed to top-down: bottom up how mainly it should be. Obviously, the applied research is more relevant to people on the ground."* **[Senior government official (G029)]**

Sharing of data was common, with institutional policies appearing to motivate more sharing across all stakeholder groups. Both researchers who indicated a contribution outcome and those who reported that they were uncertain as to whether their research findings had been used, reported more use of others' data, while those who indicated little or no contribution outcome reported less use of others' data. Approximately a third of respondents indicated that they knew the data they shared had been reused, mainly by other researchers. Respondents who had indicated a contribution outcome overall appear to have shared their analysed findings with stakeholders more than those who indicated little or no contribution outcome. Researchers who used a variety of communications channels to share their findings reported more contribution outcomes.

5.7.4 Commitment to long-term engagement

Analysis showed that more researchers who were still working in Botswana in 2018 reported a contribution outcome for research carried out under the permits studied than did those who completed their research and left the country.

Overall, the findings of the survey support the argument that long-term engagement with a research location, and its people, improve the likelihood that research is relevant to the needs of potential users, as more familiarity with the physical and social environment provides more opportunity for productive interactions. This, combined with involvement with a broad range of stakeholders, at

many stages of the research process, and involving meaningful exchange of data, information and knowledge, appears to contribute to more uptake of research. These conditions are also reflected in the case study of *Research Talks for Everyone* presented in the following Chapter 6.

Chapter 6 Case study of *Research Talks for Everyone* Event

6.1 Introduction

Determining whether productive interactions are taking place to encourage uptake of research requires examining different channels for the exchange of knowledge among research stakeholders. In the context of northern Botswana's wildlife research community of practice, there is a long-standing perception that research activities and findings that may be useful to members of this community are not adequately shared with stakeholders, and that knowledge gained by researchers leaves the country and region without benefitting local people and organisations. This is perhaps related to Botswana's relatively weak local research capacity (Botswana Dept. of Research Science and Technology, 2014; S. I. Khama, 2010; Mouton, Gaillard, & Lill, 2014), developed mainly since Independence in 1966. The desirability of the country as a destination for foreign research scientists, especially because of its natural environment, and, in recent years, its public health challenges (Ramogola-Masire et al., 2020), might also be a contributing factor. Without a broader awareness and understanding of research being carried out in the region, it is less likely that the findings generated can be put to use for societal benefit.

There is a need to identify existing channels of research knowledge dissemination and exchange to explore the validity of this perception, and to investigate possible responses. One such channel is deliberate outreach by academic researchers to the broader community, in the form of an event organised as a public lecture. This type of highly structured platform provides an opportunity to observe and capture potentially productive interactions.

6.1.1 Organised public events as structured platforms for productive interactions

The SIAMPI productive interactions approach can be applied to a range of activities that bring researchers into contact with potential users of their research. Public engagement events, where researchers share their work with non-specialist audiences, can include all of these. As shown by Tindal (2016) and Lehr (2007), in such events, the pathway to uptake and change can be visualised as a series of productive interactions that contribute to conditions conducive to uptake (Lehr, McCallie, Davies, Caron, & Gammon, Benjamin Duensing, 2007; Tindal, 2016). These conditions – awareness (enhancement of interest and engagement), relevance, trust (built by mutual and equitable interactions) and understanding (opportunities for reflection) – can be interpreted as the product and process of a community of practice defined by the elements of mutual engagement, joint enterprise, and shared repertoire. Productive interactions both depend on, and create, these conditions.

Do *all* these conditions need to be in place to facilitate uptake and use? This study seems to indicate that all the conditions will not be found in a single, or even several, interactions. Rather, achievement of one or more conditions are likely to lead to further interactions that contribute to more of the conditions needed to support uptake.

This process of focusing on interactions between researchers and potential users rather than on end results – productive interactions – emphasises contribution as a part of a gradual or staged process that works towards an increase in influence, rather than attributing specific findings to specific changes (de Jong, Barker, Cox, Sveinsdottir, & Van den Besselaar, 2014; Morton, 2015; Peter, 2016). As activities taking place on a continuum of research-related activities, productive interactions can have varying degrees of likelihood that they will result in uptake – often in the form of other interactions – or in use. This calls for a framework that outlines the process of research uptake from exposure, through use, to impact, that can help in understanding the role of specific interactions that make a contribution to the societal value of research. Looking at the public lecture as the mode of knowledge dissemination and exchange, this can be represented by steps that illustrate the process of research-stakeholder interactions that could lead to uptake and use.

The following flow chart (Figure 6-1), developed from the case study examined in this chapter, shows that at each stage of the event – from planning to post-event follow-up – there were interactions between researchers (as presenters and audience members) and other research stakeholders (mainly as audience members).

At the pre-event or planning stage, the invitation to speak and the invitation to attend are initial interactions that begin the process, creating awareness of both event platform and of specific research. The invitation to speak can come from the organiser or, potential research presenters can self-invite by suggesting a presentation to the organiser. The invitation to attend opens up more interactions between the organiser and other stakeholders who are potential audience members, and sometimes between researcher presenters and other stakeholders.

At the event stage of the process, attendance constitutes an interaction among the organiser, researcher presenters, and other stakeholders who make up the audience. Question and answer and discussion sessions again engage all of these in interactions with what can be a multi-directional flow of knowledge. Following presentations and discussions, informal socialising around refreshments creates opportunities for interactions among those who wish to create or maintain connections.

Further direct and indirect interactions can take place post-event, with stakeholders following up with researcher presenters, stakeholders sharing what they learned at the event with others, stakeholders putting the research they learned about at the event to use, and the organiser indirectly following up by sending written summaries of presentations.

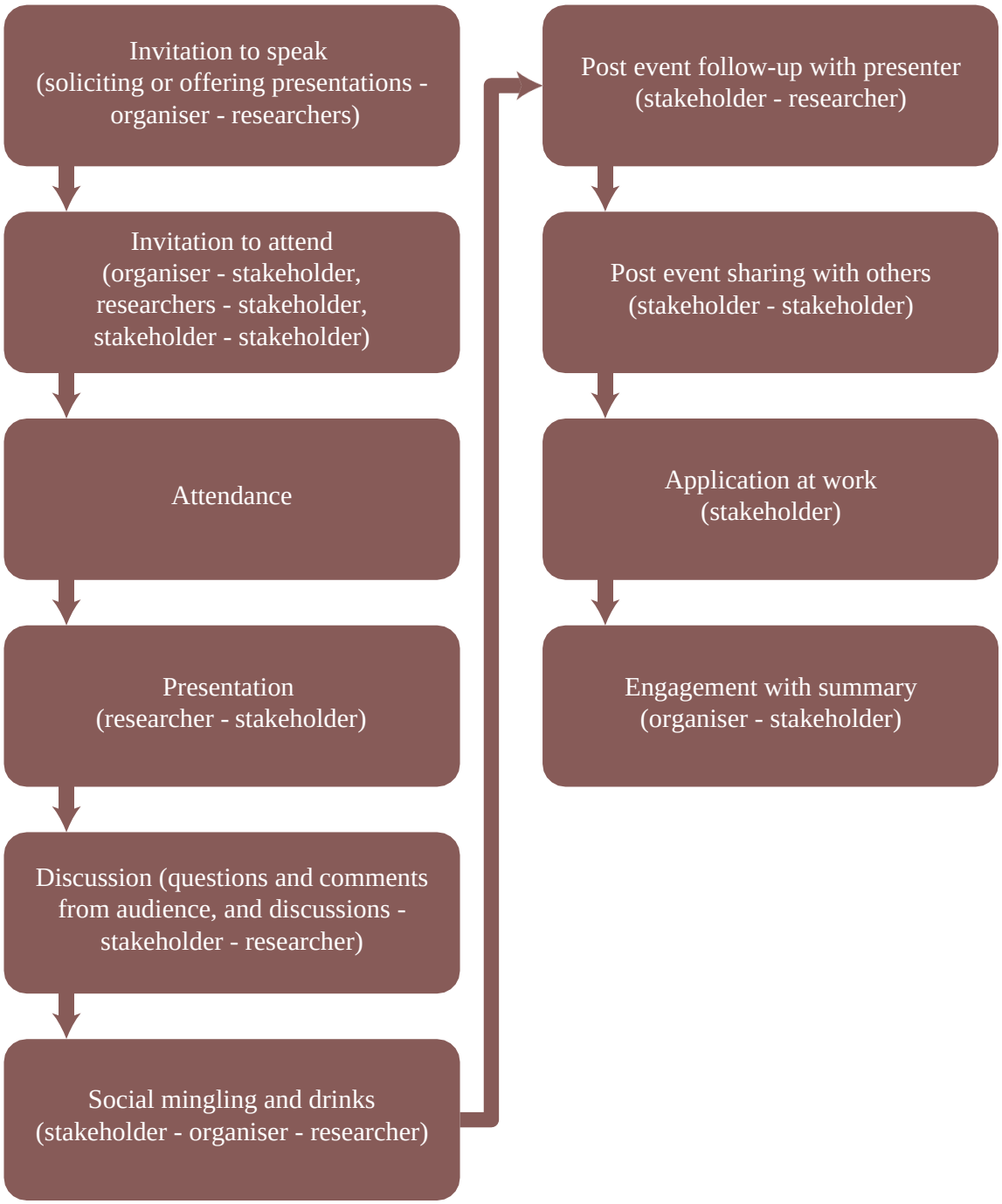


Figure 6-1 Continuum of event activities

While it is possible to visualise this process, with outcomes gradually swelling in strength and importance, the effect of individual actions and interactions involved in the process, and that contribute to possible eventual uptake and use beyond academia, can vary, depending on the context. Using a possible example from northern Botswana, a piece of scientific advice supplied to a tourism business operator may be used to change the operations of the business, without achieving the operator's intended results (allowing the interaction to be considered productive, but not impactful), while in another, external factors enable the same knowledge to produce a positive outcome for the user (allowing the interaction to be impactful).

6.1.2 Questions for the case study

The purpose of this case study was to investigate productive interactions and research uptake and use associated with planned outreach activities such as public seminars by looking into the *Research Talks for Everyone* event, a public lecture series held in Maun, Botswana to share local research with interested parties. With reference to the literature of scientific outreach to the public, specifically using the criteria identified by Lehr (2007, 2008) and Tindal (2016), and mapped against a contribution model, the case study attempts to apply some of these approaches to the sharing, through this public engagement event, of wildlife research in northern Botswana.

The questions explored were:

- Do productive interactions take place through planned outreach activities such as public seminars?
- Do the interactions lead to change in thinking and behaviour?
- Do the interactions lead to research use?

6.1.3 Outline of the chapter

Following this introduction, Section 6.2 of this chapter begins with a description of the event: its origins and motivation, and how it was carried out over a two-year period between 2015 and 2017. The role of the author and her methods of data collection are outlined.

Contextual data about the composition of the study group – the organisers, presenters and audience members involved in the event – are presented in this section, revealing patterns in attendance, institutional affiliation, event roles, and content of presentations.

Section 6.3 reports the interactions that took place throughout the stages of the event, and analyses the survey data and data collected though face to face interviews and email to explore the occurrence and nature of these interactions.

Section 6.4 looks at whether the interactions appear to have been productive, analysing the data collected to show patterns of interactions resulting in change that might be considered uptake.

Section 6.5 summarises the findings of the study to address the question, whether productive interactions take place through planned outreach activities such as public seminars.

6.2 Context of the *Research Talks for Everyone* event

Figure 6-2 Audience at Research Talks, 24 April 2017

A public lecture series jointly organised by a private sector tourism operator and a university research institute to disseminate knowledge about research activities in northern Botswana through a formal communications process is the subject of this study. The study was carried out over a two-year period, to see if the event itself could be considered a productive interaction, whether it created opportunities for ongoing productive interactions, and whether it resulted in uptake or use of the research presented.

Participation and observations during the event allowed the author to follow the event in the roles of researcher, presenter and audience member.

Data collected through attendance sheets and records of the presentations, other than the frequency of attendance that might indicate that attendees found the event useful or interesting, did not specifically address the issues of productive interactions and uptake. A web-based survey of attendees was therefore conducted to learn more about the nature of interactions associated with the event, asking recipients whether they had followed up with presenters after the event, and whether they had shared what they learned at the Research Talks (from this point on in the document,

sometimes referred to as the Talks) with others. To discover the nature of uptake, recipients were asked whether and how the Talks had affected their thinking or behaviour.

These data have been explored to discover whether the event studied could be seen to contribute to the uptake of research through its associated interactions.

6.2.1 Origin of the event

On July 27th 2015, Dr Emily Bennitt, an ecologist at the University of Botswana's Okavango Research Institute, and Sue Smart, manager at Kwando Safaris, initiated a series of public talks intended to inform the local community about research being carried out in the Okavango region. The motivation for the event was explained by Dr Bennitt:

> *"I kept hearing ... I guess from my side I was hoping that the information would trickle through attendees to other stakeholders. Also probably for less animosity towards researchers, since some tourism operators and guides were fairly negative in their attitude towards research and its value."* **[RT001 and email communication 13 June 2019]**

Similar justification for the event has been made by some of the attendees interviewed, for example:

> *"... it stops everybody complaining that the researchers never share their results, which is a continuous lament, and in fact one that I spoke about, as we hear that researchers never share their results, they never make their results available, which is not true, but if they were made available at a particular forum then everybody can see that they have been made available."* **[NGO researcher (RT005)]**

> *"I mean, if people or researchers want us on their side, which I would hope or presume that they do, then we must have information that I must be able to say to my clients, 'See that vehicle over there they are doing research on cheetah that's why they are parked off the road, that's why they stand on top of the roof with an aerial and, yes, if you go to such and such a website you can see some of the stuff that they have been doing'."* **[Tourism sector manager (RT014)]**

The original intention of the organisers was to reach out to the broader local community in the Maun area, people who the organisers had heard repeatedly say they never knew what research was being carried out in the region, even though they saw evidence of the work of many researchers in the form of professional visitors and their vehicles moving around Maun and in the field. A large part of this community was the commercial tourism sector, but it also came to include graduate students and professional researchers from local and foreign academic institutions, consultants, Non-Governmental Organisation (NGO) managers and staff members, government officials, media representatives, tourists, and local residents – many of whom worked in service and support businesses, or were retired. The event is held one evening a month at a local hotel, the venue paid for by Kwando Safaris. The events were publicised through word of mouth, an email distribution list, and the *Maun Bulletin Board*, an invitation-only Facebook page, approximately a week before the event.

Figure 6-3 Dr Jess Isden presenting in November 2016

Dr Bennitt used email and personal contact to approach researchers she knew were present in the region, many of them actively carrying out fieldwork. These were both locally based and visiting from other countries. Her email messages announcing the events often also included an open invitation to present.

The format of the Talks chosen by the organisers was three 15-minute presentations by researchers, followed by a question and answer session. A bar where the hotel sold drinks was open for the duration of the event just outside the conference room, and, following the close of the session, presenters and audience members were invited to stay on and take the opportunity to mingle and have further discussions. Written summaries of the presentations were sent out by email after each event.

The Talks can be viewed as Kwando Safaris' major engagement with Botswana research, as, at the time of this writing, the company did not employ an environmental manager. Ms Smart saw the Talks as an opportunity to create awareness of Kwando's interest and investment in wildlife conservation:

> *"I also see it as a Corporate Social Responsibility project also – facilitating open access to research in the country and sharing. This isn't the kind of place you live without a love (or sometimes hate) of wildlife – it's rather like understanding more what you live with!"*
> **[Email communication 13 June 2019]**

6.2.2 Organisation of the event

The event consisted of three separate presentations of 15 minutes duration, with questions from the audience invited after each presentation, and at the end all presentations. Most speakers made their

presentations while standing freely, used slides, and sometimes used the microphone. After closing of the event, some attendees mingled at the bar outside the conference room, chatting for up to 30 minutes before leaving the hotel, and sometimes leaving together:

> *"Quite often a group of us will go out for dinner to a different location. ... Usually it is a group of people that knew each other already (but other folks have joined) and we don't always talk about the topics covered by the research talks, but it does happen."* **[Email communication, 19 June 2019]**

At the time of writing there have been more than 50 events in the continuing series.

6.2.3 Attendees and presenters

Attendance data were collated by the author twice during the collection period between October 2015 and October 2017, analysed and shared with the organisers. The summarised analysed data were shared publicly through a presentation made at the Talks in October 2017, when participants were asked if they would be willing to participate in a follow-up survey.

Table 6-1 and Figures to 6-4 to 6-12 illustrate the nature of the event during this period.

Table 6-1 Breakdown of attendees, September 2015 to October 2017

Number of individual attendees	**377**
Male	201
Female	176
Botswana residents	293
Visitors	84

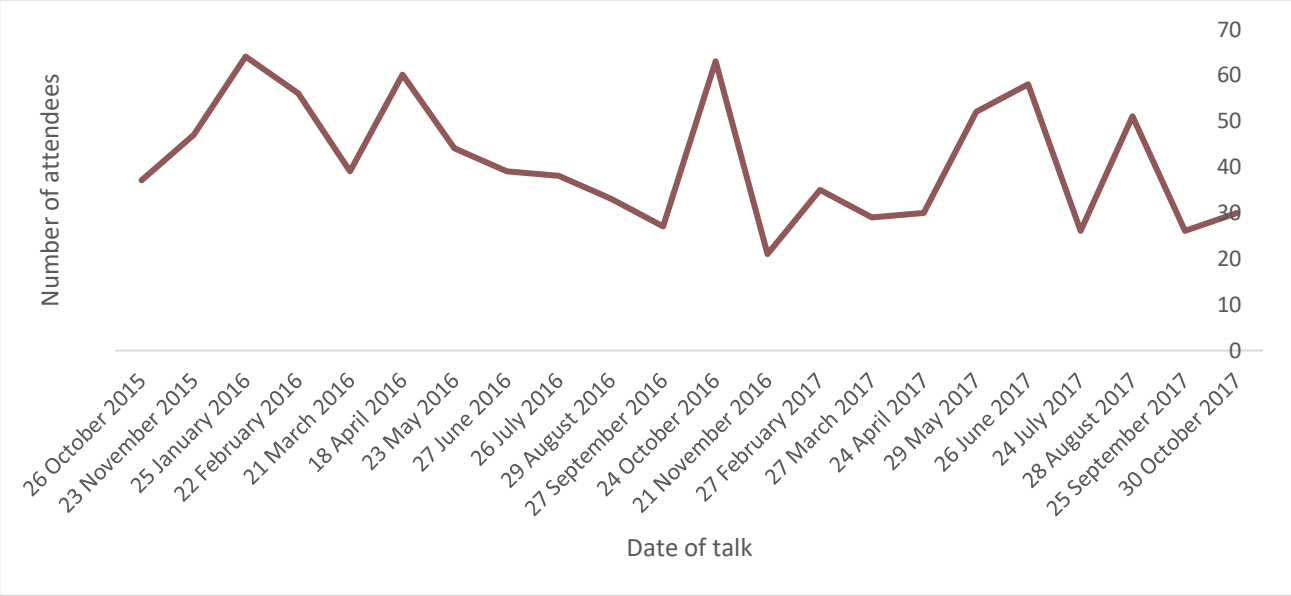


Figure 6-4 Number of attendees over the study period

The event was not held during the month of December and restarted at the end of the first month of the following year. The number of attendees over the two-year study period varied between 20 and 63 per event (Figure 6-4). Given the number of tourism industry attendees, one might expect lower attendance during the safari tourism high season, which runs from April until September; there was a slight indication of this.

The institutional affiliation of attendees, analysed from the attendance data, is shown in Figure 6-5.

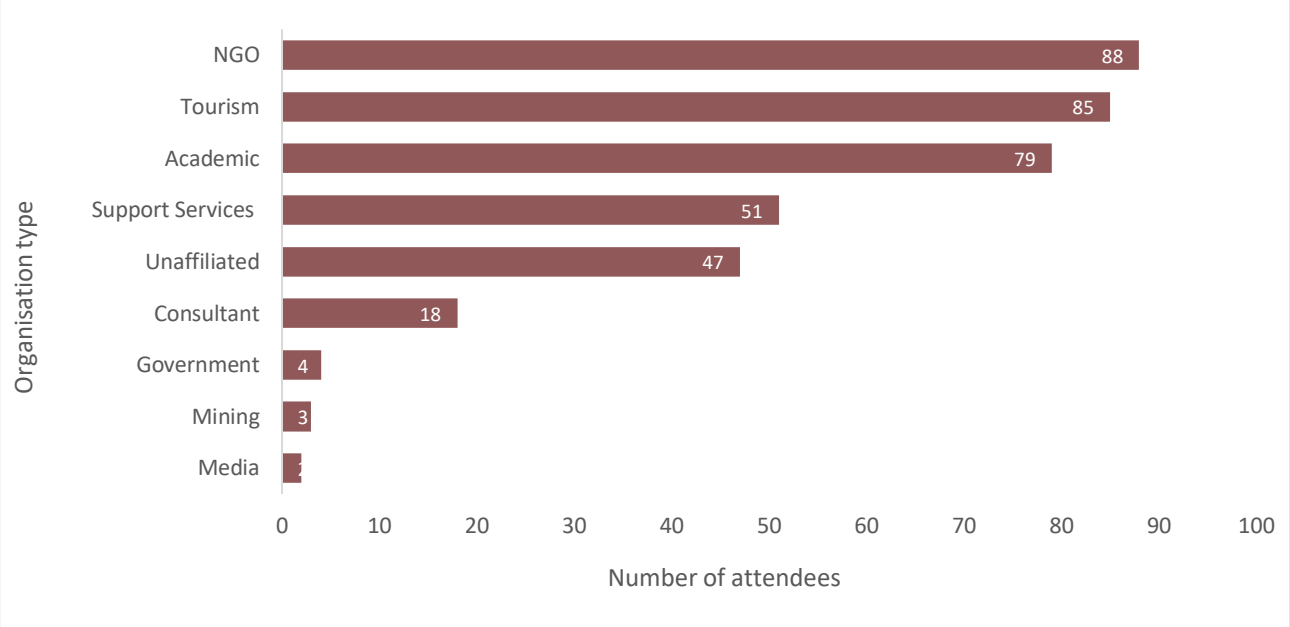


Figure 6-5 Institutional affiliation of attendees (n=377)

From attendance data, staff and managers from NGOs were the largest group of attendees, followed closely by people working in the tourism industry, and academic researchers. The reason that representatives from government, including Okavango Research Institute staff members, rarely attended was understood to be the time of day, after normal working hours (Personal communications, TB and CT, DWNP, 2017, 2019). Dr Bennitt observed:

> *"[Government official, name withheld] wrote to me, so they are on the mailing list, to get the summaries and invitations, and wrote in about one of the summaries saying, 'Can I get the contacts for this person?', so obviously he's reading, but the problem with deciding to start at six o'clock it was the ultimate time to catch people just after work. Obviously, it doesn't work for the government people, but if we did it earlier, we would lose the public, and I feel like because the reports are sent to the government, they are aware of what's going on, and they get the summaries. So their attendance isn't so critical and we do meet at workshops all the time."* **[Academic researcher at institution (RT001)]**

Understanding who participated in the event, and in which roles, is important in analysing the interactions that took place, as there was overlap between presenters (researchers) and audience members (researchers and other stakeholders).

In the survey, the attendees were asked for their organisational affiliation, supplying them with eight choices and allowing them to select 'other'. The eight responses specified under 'other' were categorised using the categories. Figure 6-6 illustrates the breakdown of organisational affiliations as reported in the survey.

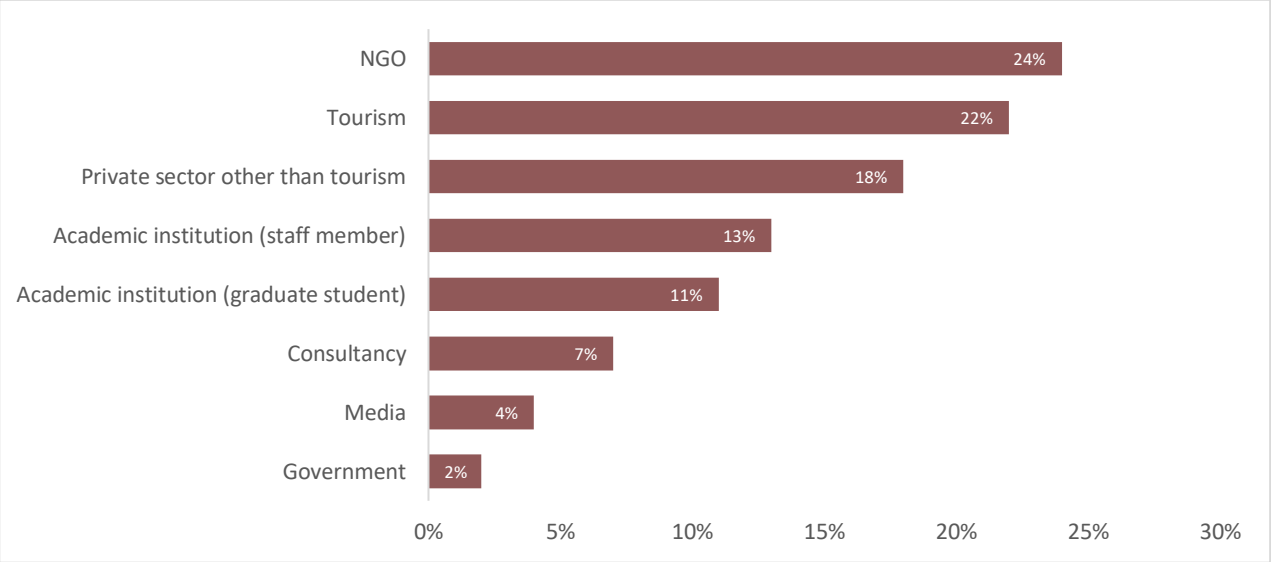


Figure 6-6 Organisational affiliation of survey respondents (n=55)

The highest number (24%) of the respondents were affiliated with NGOs, followed by the private tourism sector (22%), which corresponds to the overall makeup of attendees during the study period as previously shown in Figure 6-5. When the organisational affiliations are grouped into three categories – NGOs, academic, and private sector – however, results of both attendance records and the survey show that participants from the private sector were the largest group. This is illustrated in Figure 6-7.

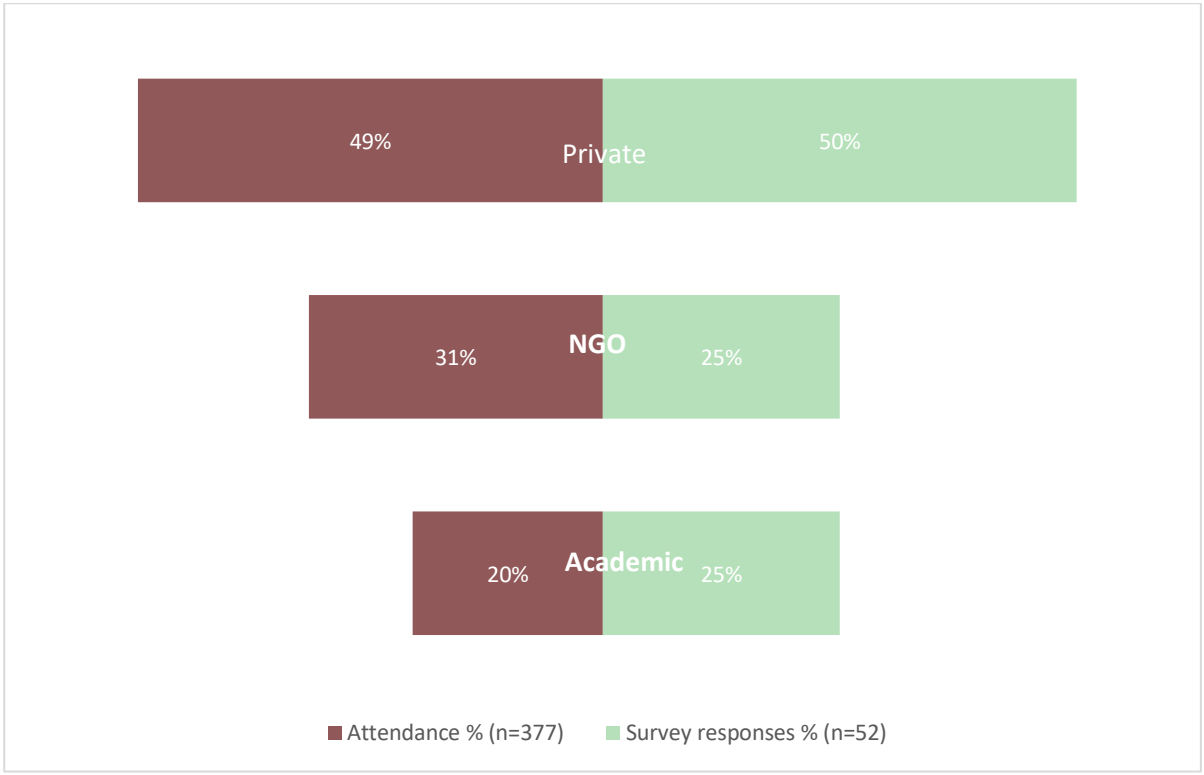


Figure 6-7 Comparison of attendance records with survey responses

Note: Government was excluded because there was only one response.

The number of people who attended the Talks each time was counted from the attendance records (Figure 6-8). The majority of attendees participated once, but there was a small core group of regular attendees. For a period of two years, the highest frequency of attendance by one person was 14 times.

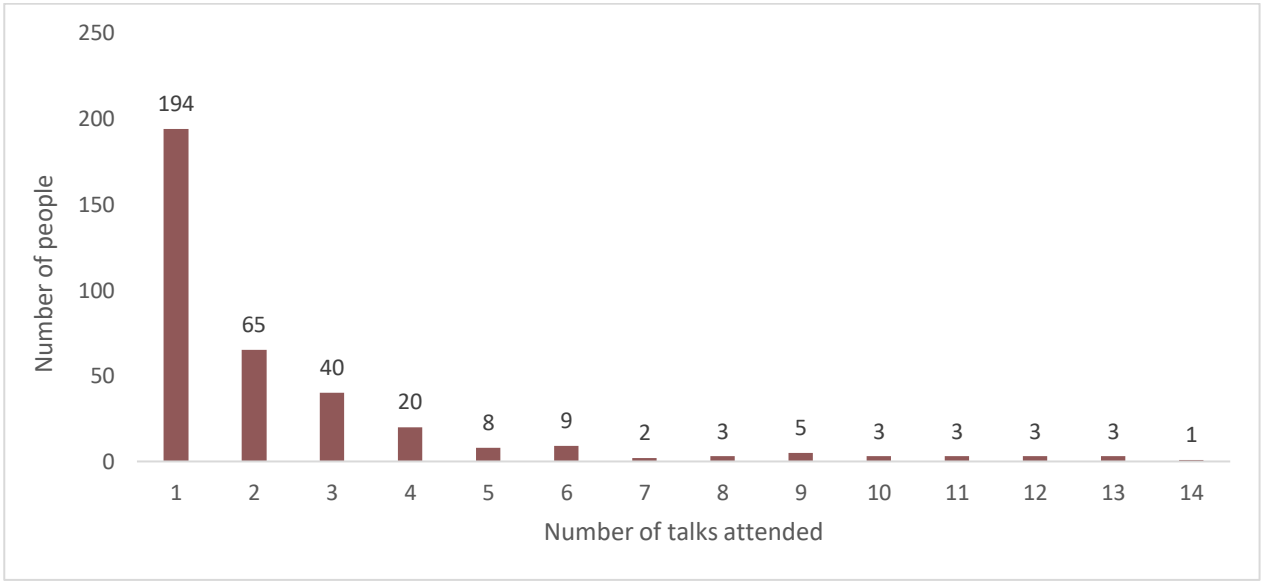


Figure 6-8 Return visits reflected in number of talks attended (n=359)

Survey responses indicated that, from those who attended more than once, it was most common to attend from three to five times a year (Figure 6-9).

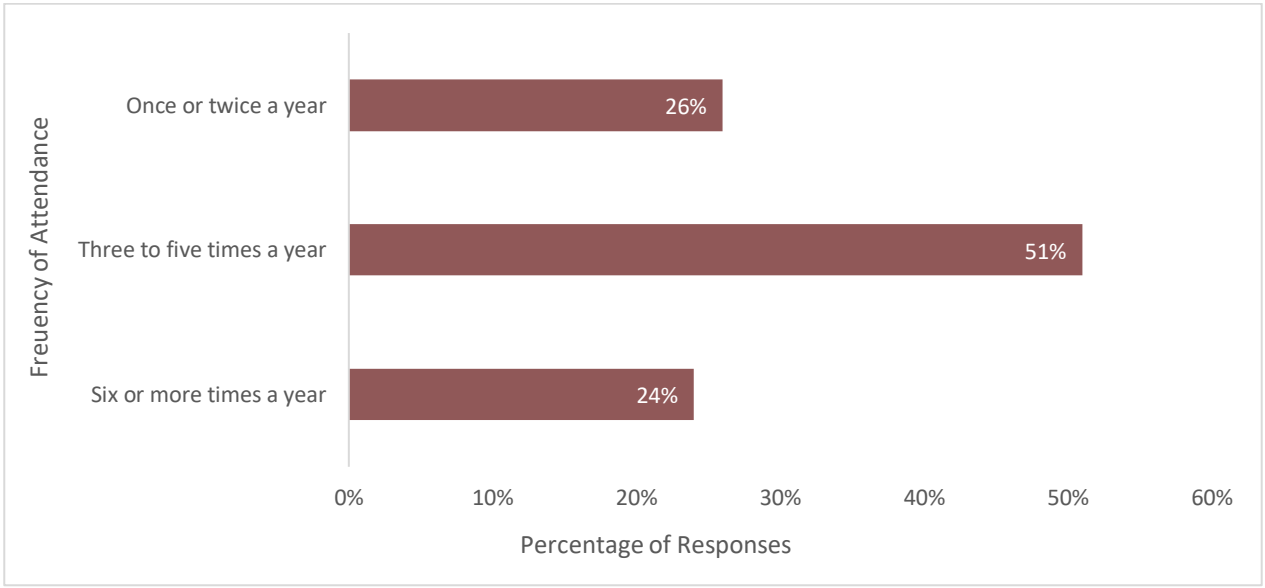


Figure 6-9 Frequency of attendance (n=55)

Sixty-eight presentations were made by 51 researcher speakers during the two-year study period. Records of the presentations show how some presenters returned to speak again at the event. Figure 6-10 indicates how frequently this occurred.

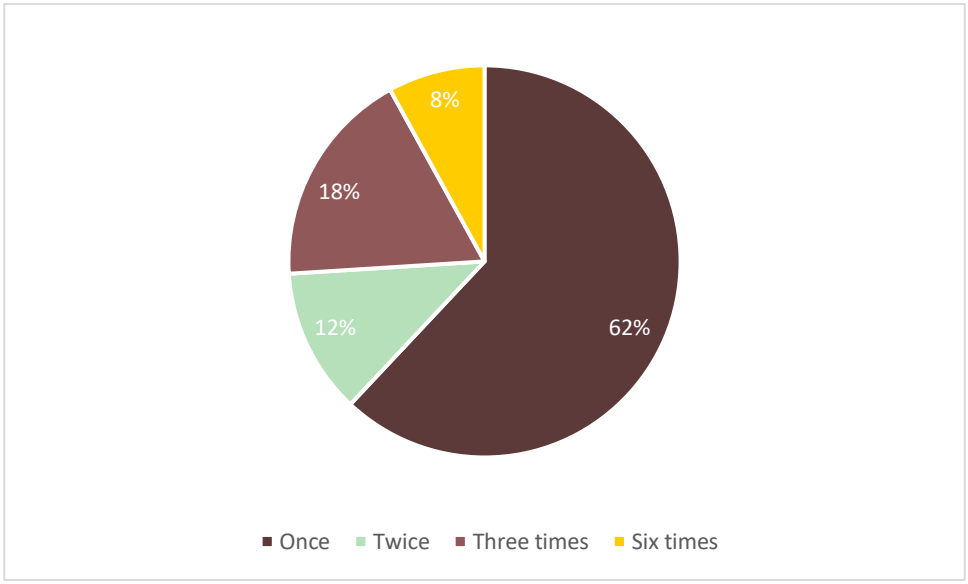


Figure 6-10 Times individual speakers returned (n=68)

Most speakers (62%) presented only once, but several returned to speak again (12% presented twice and 18% presented three times). One speaker made six presentations during the observation period.

The topics of presentations, captured in records, were categorised into four for the purpose of this study:

- animal (wildlife species and conflict studies, e.g. *Dispersal and demographic consequences in the endangered African wild dog: an overview*);
- physical geography (geomorphology, hydrology, geology, climate, and environmental studies, e.g. *The 'barchans' of Ntetwe Pan: implications for the Makgadikgadi Management Plan*)
- socio-economic (studies of society and the economy, e.g. *Preventing and responding to violence against women and girls in Maun*), and
- vegetation (botanical, land cover studies, e.g. *Incorporating three-dimensional vegetation structure in environmental studies*).

Figure 6-11 shows the breakdown of topics from the 68 presentations made in the relevant two-year period.

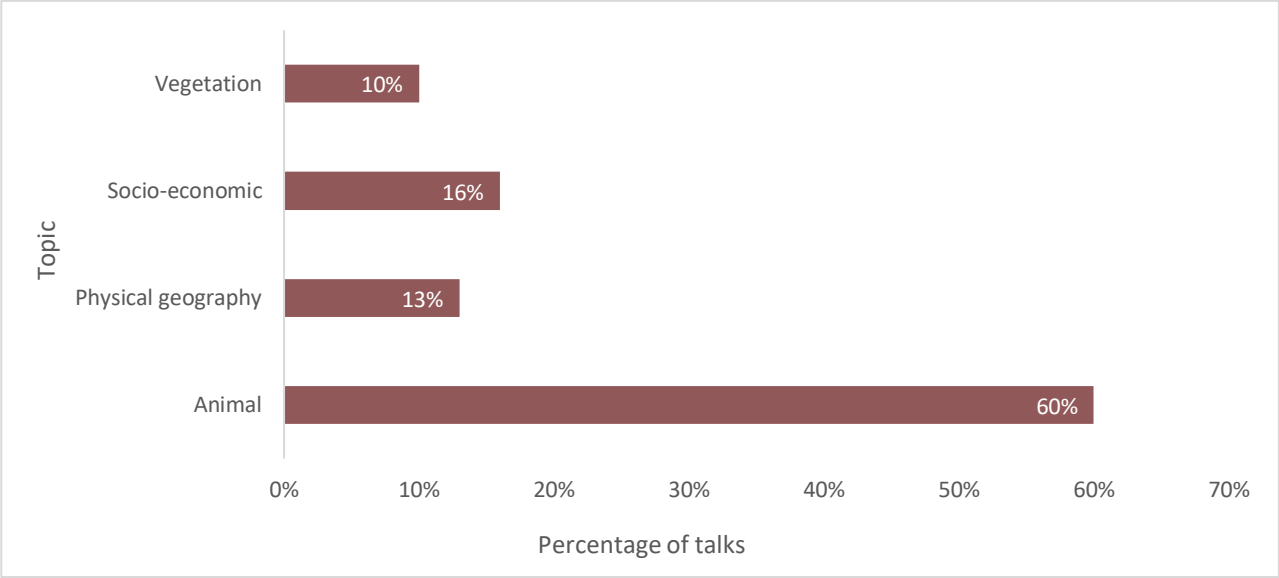


Figure 6-11 Topics of the presentations (n=68)

Most presentations in Figure 6-11 were species-focused studies of wild animals (60%), followed by those focused on socio-economic issues (16%), geographic studies (13%), and vegetation (10%). The full list of the presentations made during the study period at Appendix 4 shows an increasing emphasis on the implications of human-wildlife interactions over the two years of the study.

For each of the 68 presentations, the organisational affiliation of the speakers was also captured from the attendance records and is shown in Figure 6-12.

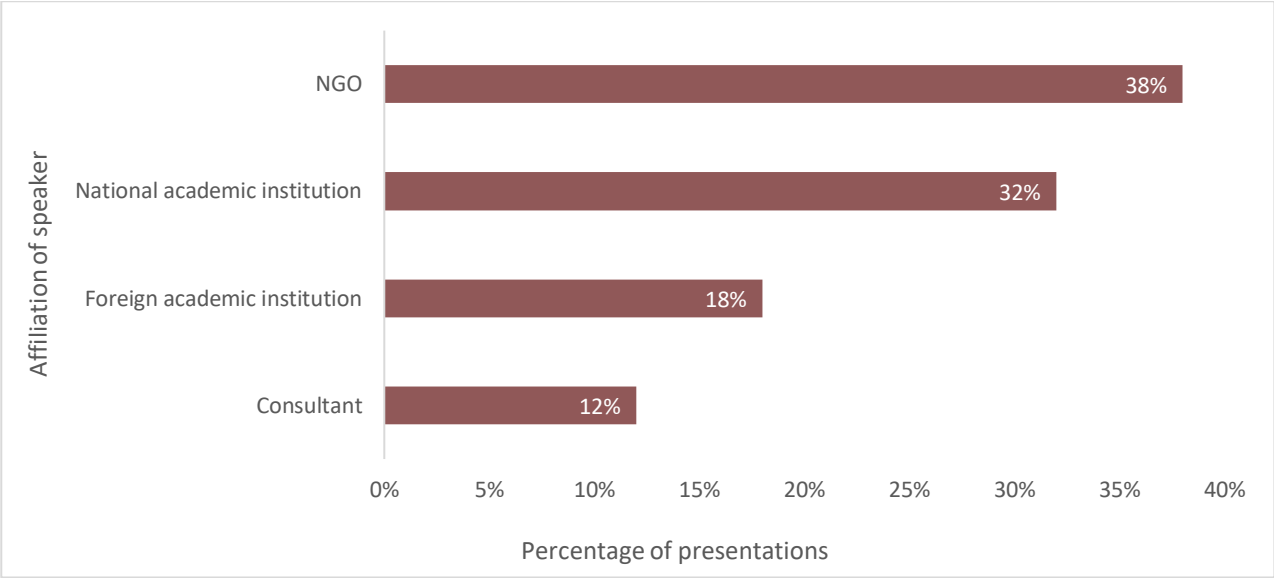


Figure 6-12 Affiliation of speakers (n=68)

While the percentage of presentations made by from academic researchers and NGO researchers was about equal, 20 of the 32 speakers from NGOs were graduate students who were carrying out their study fieldwork with the NGOs. Overall, there were 25 (37%) student speakers and 43 (63%) non-students. There were few presentations from consultants producing research under contract to government. Among the academic presenters, 12 (35%) of the presenters came from foreign institutions.

The number of times organisations sent speakers is shown in Figure .6-13.

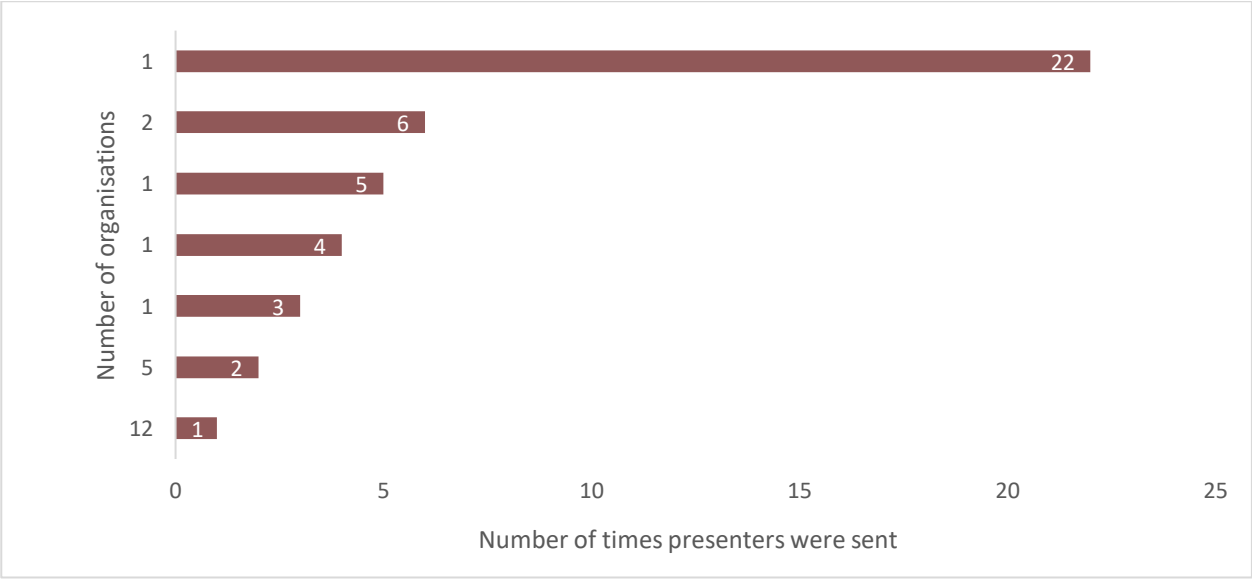


Figure 6-13 Number of times organisations sent a speaker (n=68)

For the 68 presentations made during the study period, twelve organisations sent a presenter once, while one organisation (the University of Botswana Okavango Research Institute), sent speakers on 22 occasions (Figure 6-13). Other organisations sending speakers more than once – from two to six times – were NGOs.

Attendees who completed the survey were asked if they had attended the event as presenters only, as audience members only, or as both. Figure 6-14 shows the roles acknowledged by the respondents.

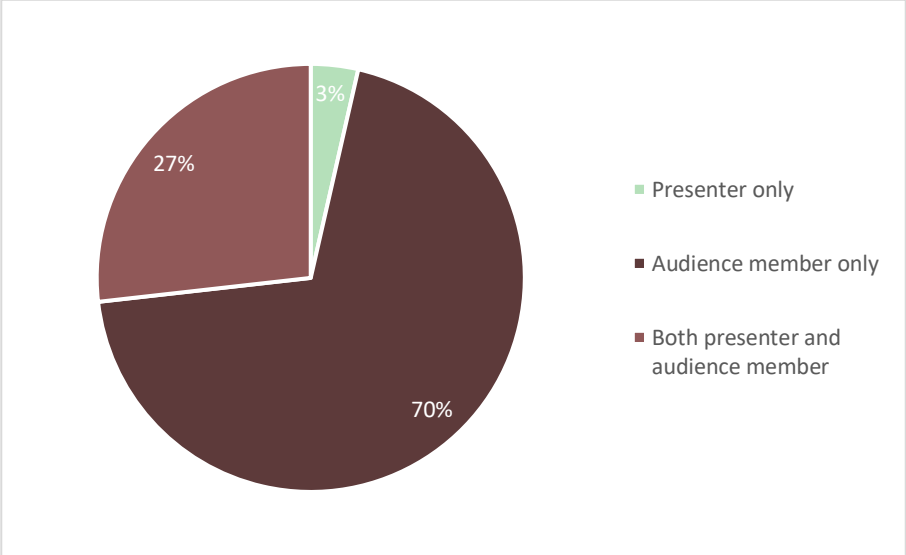


Figure 6-14 Roles of attendees (n=56)

Most respondents (70%) saw themselves as having been audience members only, 27% said they had participated as both presenter and audience member, and only 3% stating that they had only participated as a presenter.

Figure 6-15, which is also based on the survey results, illustrates a combination of responses about these roles and responses about attendees' affiliation with organisations.

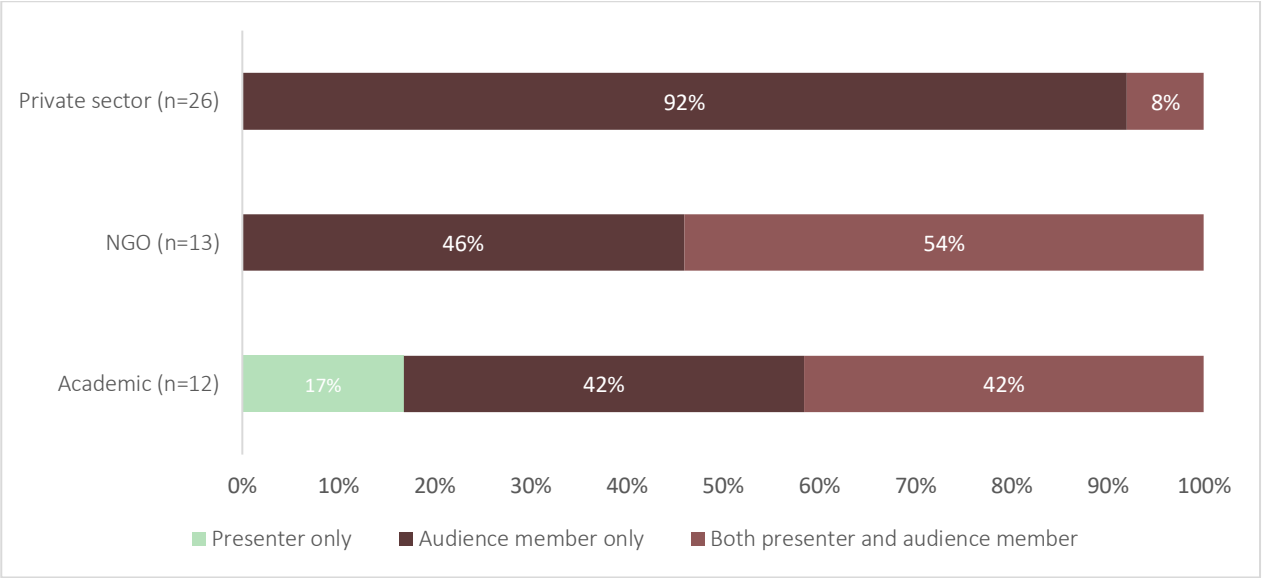


Figure 6-15 Role of attendee by affiliation

The following statistically significant differences ($p<0.05$) were observed, according to a Bonferroni test for comparison of proportions:
"Private sector" (92% audience member only) > "NGO" (46% audience member only)
"Private sector" (92% audience member only) > "Academic" (42% audience member only)
"NGO" (54% both presenter and audience member) > "Private sector" (8% both presenter and audience member)
"Academic" (42% both presenter and audience member) > "Private sector" (8% both presenter and audience member).

Those who identified themselves as audience members only were mainly from the tourism sector, other private sector, and government. Academic institution staff members – professors and lecturers – also mostly identified themselves as audience members only. By contrast, graduate students identified themselves as mostly (67%) both presenters and audience members.

The first of a chain of possible interactions between researchers and others occurred when they were invited to speak or attend the event (as in Figure 6-1). The survey respondents were asked how they had originally learned about the Talks. They were supplied with three choices and given the option of responding with 'other'. All the responses under 'other' were categorised using the existing options. Figure 6-16 shows the sources of first information about the event.

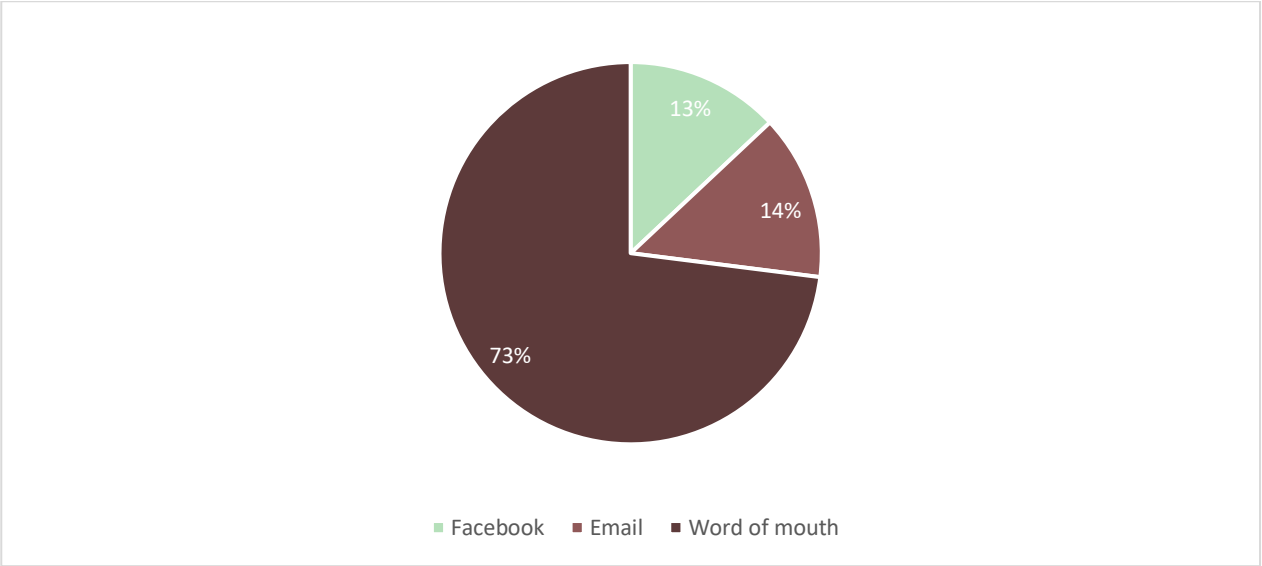


Figure 6-16 How attendees learned about the Talks (n=56)

Most of the respondents (73%) reported that they had learned about the Talks through word of mouth, indicating an initial direct, interaction related to the event. Awareness was created as part of a series of interactions. This speaks to considering the stakeholders included in this study as a community of practice: activities of researchers, NGOs and the private sector are intertwined, and mutual engagement for one reason – such as sharing of transport – can lead to the shared repertoire resulting from a public lecture.

> *"… before [a foreign researcher] left because I ended up driving a Land Rover that he was using before he left he said "… we were invited to a talk 'I will be one of the speakers at Maun Lodge' … that's when I started."* **[Safari guide (RT008)]**

Motivation for attending an event can be influenced or affected by interactions with others. Respondents were asked about their initial and current motivations for attending the event and were given seven possible responses. They were also allowed to indicate other motivations as free text comments. These comments were incorporated in the original categories. Figure 6-17 compares the two sets of responses.

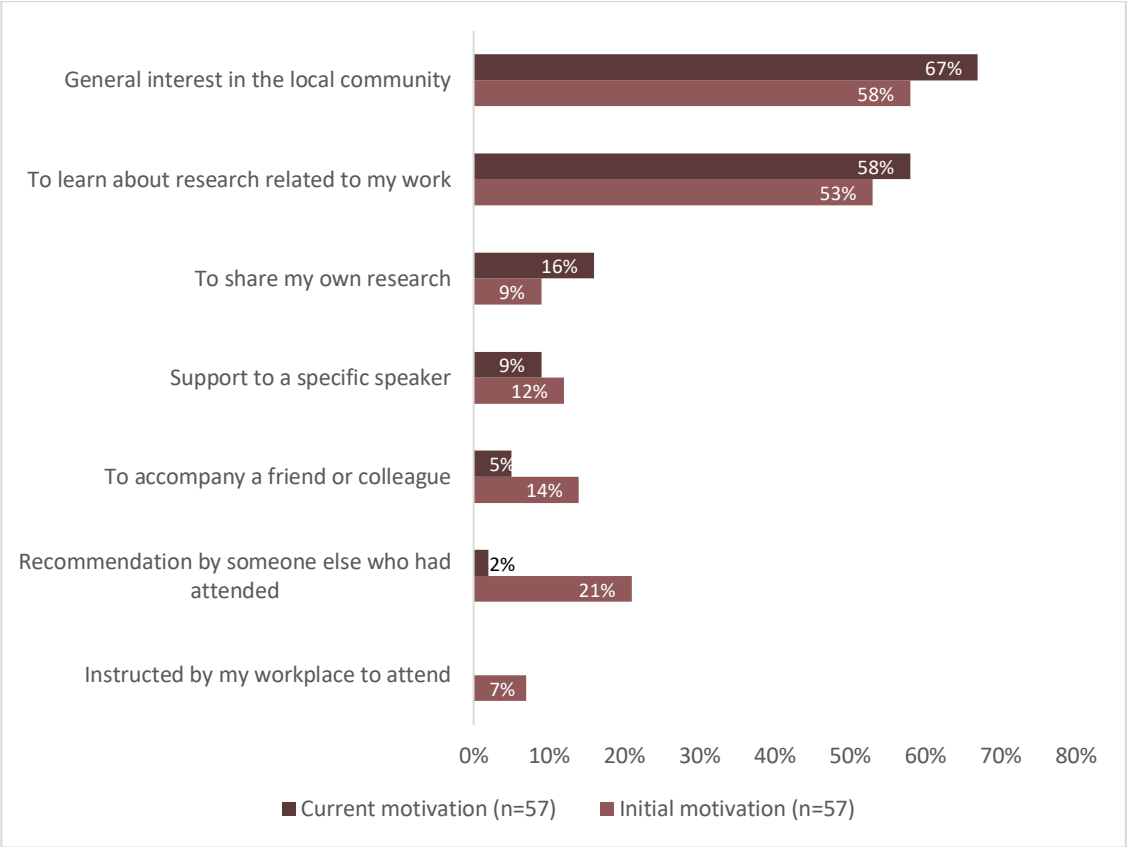


Figure 6-17 Initial and current motivations for attending the Research Talks

More than half of respondents reported that they originally attended the Talks out of a general interest in the local community (58%), with slightly fewer saying that they had wanted to learn about research related to their work (53%). When asked about their current motivation for attending, both of these motivations had slightly increased (67% and 58%), while the only other reported motivation that had increased was to share the attendee's own research (from 9% to 16%).

Among attendees from the private sector, there appeared to a mix of reasons for attending, but there was an emphasis on personal interest that also happened to be relevant to the tourism industry. Some examples of this from follow-up interviews follow.

> *"I think those who attend Talks from the tourism industry do so out of personal interest, not because what they learn can be used in their business."* **[Safari tourism manager (RT004)]**

> *"I'm an ecologist, I don't work as an ecologist at the moment. And I actually thought, way back when, about doing my own research, but I never got around to it – life happened…. So it's just interesting for me to follow what other people are finding out, and see it's useful. Because I think that's actually why I didn't follow my research because I've thought, ah, there is so much research that's not useful. So let me come and hear what others are doing and see if it is useful. And what I have seen is that some research really doesn't seem to really go anywhere but quite a bit, you know, people are putting into practical use. Which is great."* **[Local private sector service provider (RT006)]**

> *"... getting potential information that I could share with my clients ... and it's just interesting to see which projects are running ... listening to the people who are doing the studies and having that kind of background while I'm coming from a very different angle...."* **[Safari tourism manager (RT002)]**

> *"I spent a little bit of time very recently with the [senior local official] at the meeting with the [name withheld] community and afterwards I took him and his crew on a short drive to see the [area] and he specifically mentioned the talks and that he likes to go there, because it keeps him on the research side a bit*." **[Consultant (RT012)]**

Respondents were also asked if anything limited their attendance, and were given five options, as well as the option to report under 'other'. Respondents could choose more than one. These responses are shown in Figure 6-18.

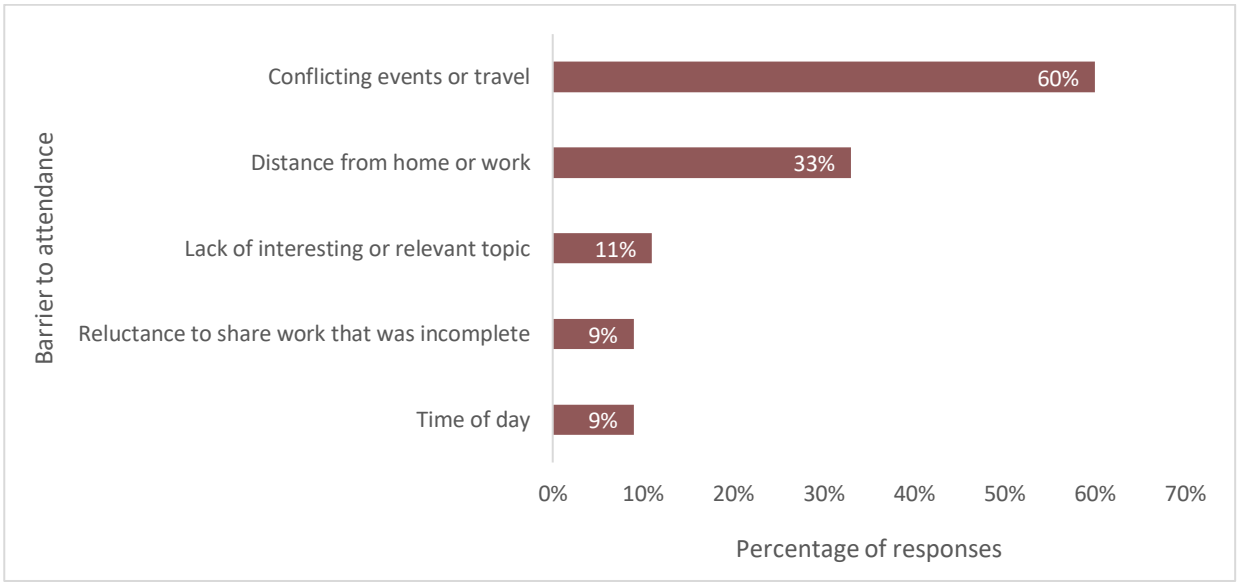


Figure 6-18 Barriers to attendance (n=57)

Most respondents (60%) reported that conflicting events or being away on travel limited their participation. Lack of an interesting topic was only occasionally mentioned:

> *"You are not always going to have; I mean, normally out of the three, there is one that interests us. Once in a while there is one that surprises us. ... I mean if there is absolutely nothing of interest, if I just like I came back yesterday. I'm looking forward to the one about herbivores and food supply. I'm interested in hearing that, but if there weren't anything interesting, I wouldn't have come tonight."* **[Safari tourism operator (RT014)]**

6.3 Interactions of attendees as a result of the Talks

The survey dataset was explored, together with the interview data, to determine if interactions had taken place that could be considered productive: that is, if there were patterns of interaction that indicated the research findings shared at the Talks were moving into use. The Talks event, itself considered an interaction, could generate further interactions among researchers and stakeholders, both at the event and outside it.

In addition to the basic interaction of participation by listening to presentations and discussions, survey responses about three other types of interaction were considered:

1) Mingling and drinks following the presentations
2) Follow-up by attendees with a presenter
3) Sharing by attendees of what was learned at the Talks.

6.3.1 Mingling following presentations

At the end of formal part of the event, attendees were invited to stay and chat over drinks in the lobby outside the event room. This gave attendees the opportunity to ask further questions of the presenters and to talk among themselves. Follow-up interviews with survey respondents provided some insights about the interactions that took place during this activity.

Most reported that they stayed on for drinks and mingling after the presentations, and that the conversations included further discussion of the content of the presentations.

> *"I usually try to stay on, and, in my observation, the conversations are usually about the topics covered in the presentations."* **[Private sector tourism manager (RT004)]**
>
> *"There is a lot of talk about some of the presentations, definitely."* **[Consultant (RT012)]**
>
> *"We went to dinner afterwards – a group of us. Some I knew and others were new. We did talk about the presentation and my project, but nothing really came of it as far as I know."* **[Academic researcher (RT013)]**

Interviewees also reported that people took advantage of the occasion to reconnect with one another and have conversations that were not necessarily related to the presentations.

> *"Some are talking about some of the topics, yes, but for everything, things more on to what's happening in Maun and you'll hear what other people are talking and what's happening with the water. And conversation will probably end with, does anyone know anything about the water."* **[Private sector mobile safari operator (RT014)]**
>
> *"Depends on the individual, usually it's talking about the topic for a little bit and what I have seen, what's mostly happens is, if you don't know the person, you go off immediately and you chat with that person about the topic, and if you know the person, 'Let's grab dinner, or tomorrow I would love to pick your brain about this or that', so there is definitely a range of, but usually it stays fairly on topic. … I think anyone who has done research especially in Africa, or outside the United States, or developed countries, knowing people and mingling with people is such an important component to all of this and just having those conversations by creating a space where everybody feel comfortable going is so important."* **[NGO manager (RT011]**

Sometimes the mingling led to further follow-up interactions. For example:

> *"… the questions and the mingling are probably the most important I mean in terms of knowledge sharing I think, because the questions are public so you get the discussions with everyone and then the mingling can be more intense and say 'Ok, I want to talk to you about this or that' and we have had one that leads to the other. For example, I think it was*

[name of NGO] that were talking about taking kids into the parks and then Kwando [the Talk organiser] publicly said, we can help with that: let's talk after this. So I think you can get that's a sort of trail leading from the question into discussion." **[Academic researcher (RT001)]**

6.3.2 Follow-up with a presenter

Respondents were asked whether they had further engaged with the research they heard about at the Talks by following up with a presenter – a direct interaction. If they responded that they had followed up, they were asked to describe the follow-up in an open response. Figure 6-19 shows the result.

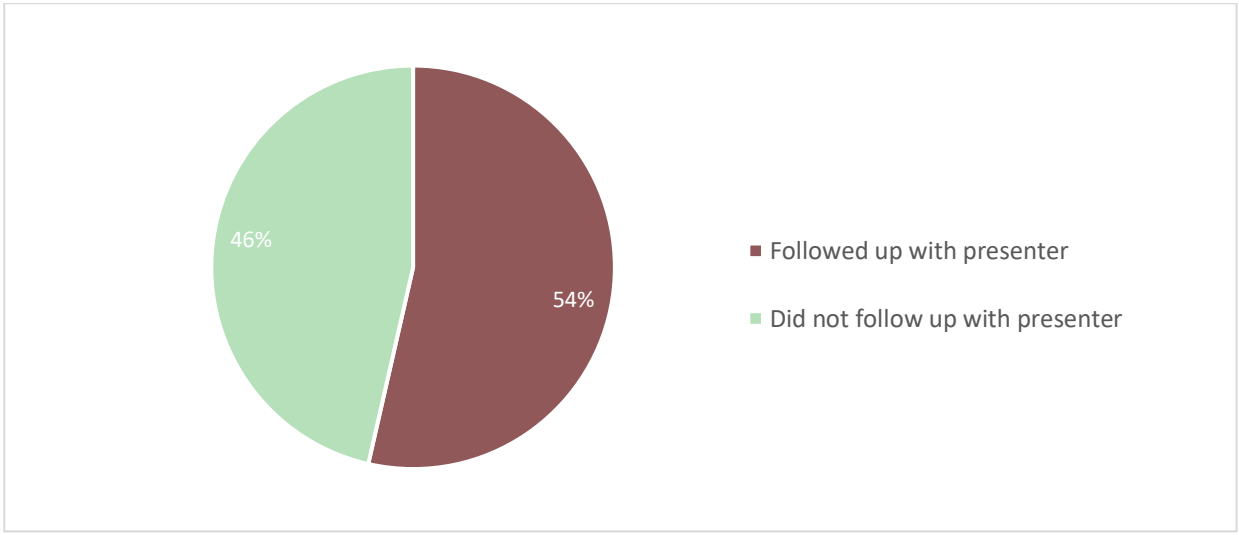


Figure 6-19 Follow-up with presenter (n=56)

Slightly more than half of the respondents (54%) reported that they had followed up with a presenter after hearing them speak. The reasons given for follow-up, sometimes more than one per respondent, were coded into the nine categories presented in Figure 6-20.

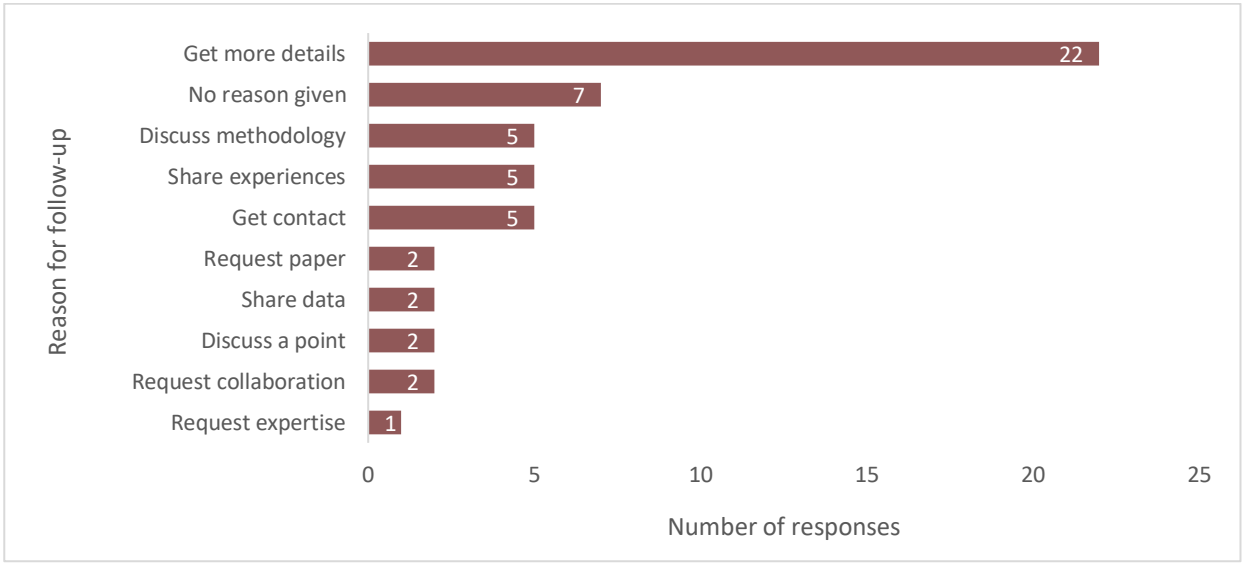


Figure 6-20 Reasons for follow-up

The most mentioned reason for follow-up was mutual engagement to get more details about the topic presented. Some examples of this follow here.

> *"Specific topics that have been related to the Delta that I've found interesting or potentially interesting for customers."* **[Private sector manager]**
>
> *"Generally after the presentations I will go over to them if I have any extra questions or comments regarding their work."* **[NGO manager]**
>
> *"I followed up with a presenter who was working on a similar topic of research and I was interested in learning more about their work beyond the scope of the presentation."* **[NGO researcher]**
>
> *"We know our friend [name withheld] who runs a plant nursery was very interested in the talk by* [NGO researchers]*, and talked further with them about the invasive plants."* **[Private sector mobile safari operator (RT014)]**

Sometimes follow-up with the researcher to learn more about the research led to further engagement in the form of sharing of experience, provision of expert advice, or collaboration, moving the interactions towards joint enterprise. Examples of this follow.

> *"We followed up with [Academic researcher] after he presented … he has been instrumental in setting up a similar monitoring system in our camps. Have also followed up with [NGO researchers] regarding invasive species."* **[Tourism manager]**
>
> *"Set up discussion, exchange contact details, ask for literature."* **[NGO researcher]**
>
> *"Yes I discussed with [Academic researcher] from [academic researcher] camp and Doctor [Academic researcher] who was doing camera traps in Moremi and NG 33 and 34, talking about my voluntary work that I do during my quiet season and that I will be interested in doing monitoring work and I work with some of the schools in my area just doing presentations in schools about wildlife and how to take care of our environment."* **[Tourism guide]**
>
> *"[Academic researcher] approached me after he spoke about the wild dog dispersal. We agreed to collaborate in getting guests to contribute their photos to his project. He provided us with a WhatsApp app and a flyer to give to the guides and the guests. As far as I know some of them have used it."* **[Tourism manager (RT004)]**
>
> *"We followed up with [academic researcher] after he presented on using guest photos to estimate predator densities…. When the guests came in for orientation, we had a two minute pitch, told them about the project, what we were doing…. Then we gave give them a little GPS tracker to take on their game drives…. We shared the data with him and also to just get an idea of what we are, this is obviously down to identifying individual animals within the concession, the lions with the whiskers, spots and the body patterns, and we still use these data bases now, we are actually busy now updating them in the moment, those been priceless."* **[Tourism manager (RT007)]**

Sometimes, though, if there are resource constraints, either in the form of time or funding, the train of interactions ends at this point. Awareness, trust, and understanding have been created, and relevance acknowledged, but joint enterprise cannot take place:

> *"I am sure it happens, potentially, there was a guide that approached me about camera trapping, something would have come out of that if I had money to buy half a dozen camera traps, I didn't, so it didn't."* **[NGO researcher (RT005]**

Some audience members engaged more deeply with the substance of the presentation by discussing methodology and findings, and by sharing data. Some examples of this follow.

> *"I disagreed with one presenter about facts in his presentation."* **[Private sector manager]**
>
> *"To learn more about their methodology."* **[Graduate student at Botswana institution]**
>
> *"Supplying survey data for their research and further work."* **[Professional researcher from outside Africa]**
>
> *"That cyclical thing, circles around waterholes, and he was the one who said that the elephants weren't damaging the environment in any way. All four of us completely disagreed. We thought that this research weren't the conclusion that it reached; he didn't have the authority to say this. He hadn't done the research for long enough and when people challenged him, he said, 'I haven't been in the field long enough' so I thought maybe if he had come out and said it in a different way, and said this is what it looks like we are finding these are like the interesting things we are finding rather than saying, elephants are not impacting in a negative way."* **[Private sector mobile safari operator (RT014)]**

Participants in knowledge sharing events open to the public come with varying levels of experience and exposure to the variety of topics presented, depending on their education, social status, and current work environment. It may be that pre-existing knowledge or familiarity with a topic, or that reluctance to engage with an expert who might think negatively about their ignorance, influence the ability of participants to cross these boundaries to engage further with the new knowledge shared. While acknowledging that northern Botswana's wildlife community of practice is made up of many people who have changed professions and employers and so have a variety of previous experience, it is possible to try to discover whether there was a relationship between attendees' organisational affiliation and whether they followed up with a presenter. The following Figure 6-21 shows survey respondents' follow-up with presenters, broken down by organisational affiliation.

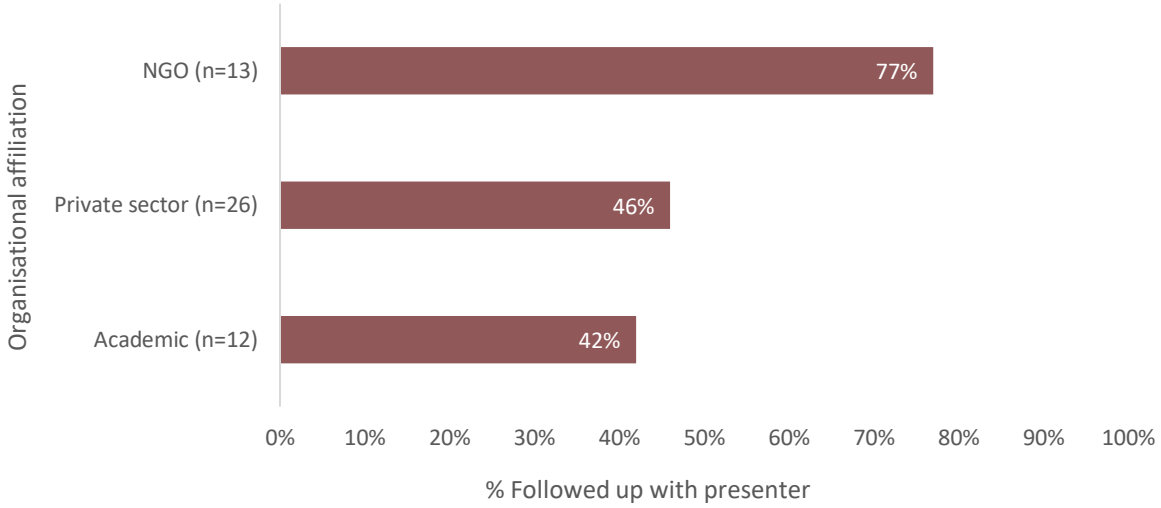


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Figure 6-21 Follow-up with presenter by organisational affiliation (n=27)

No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Respondents affiliated with NGOs reported the most follow-up with presenters (48%), followed by those from the private sector (33%). Attendees who were affiliated with academic institutions as staff members reported that they engaged less in this type of interaction.

It might be thought that the roles of attendees in an event influence the likelihood of audience members interacting with presenters. The roles of attendees – presenter only, both presenter and audience member, and audience member only – were examined to see if there was a relationship between these roles and whether respondents reported follow-up with a presenter. Figure 6-22 shows the results.

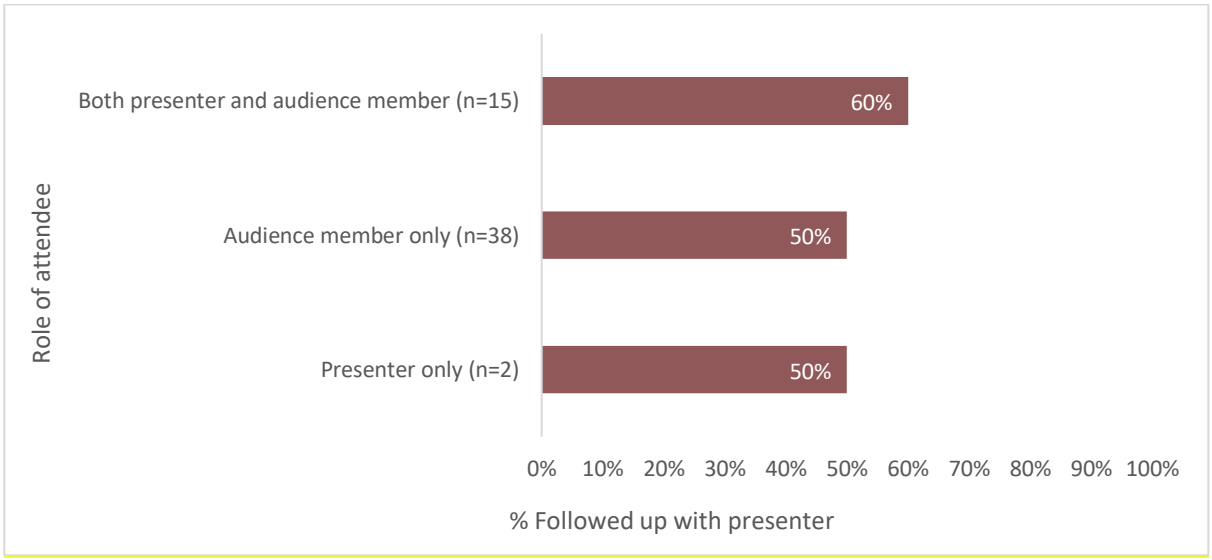

Figure 6-22 Follow-up with presenter by role of attendee

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Respondents who viewed their role as both audience member and presenter reported the most follow-up.

Interest levels, possibly indicated by frequency of attendance, might be thought to influence willingness to engage with presenters about their work. Reported frequency of attendance was therefore compared with whether respondents followed up with a presenter. Figure 6-23 shows the results of this comparison.

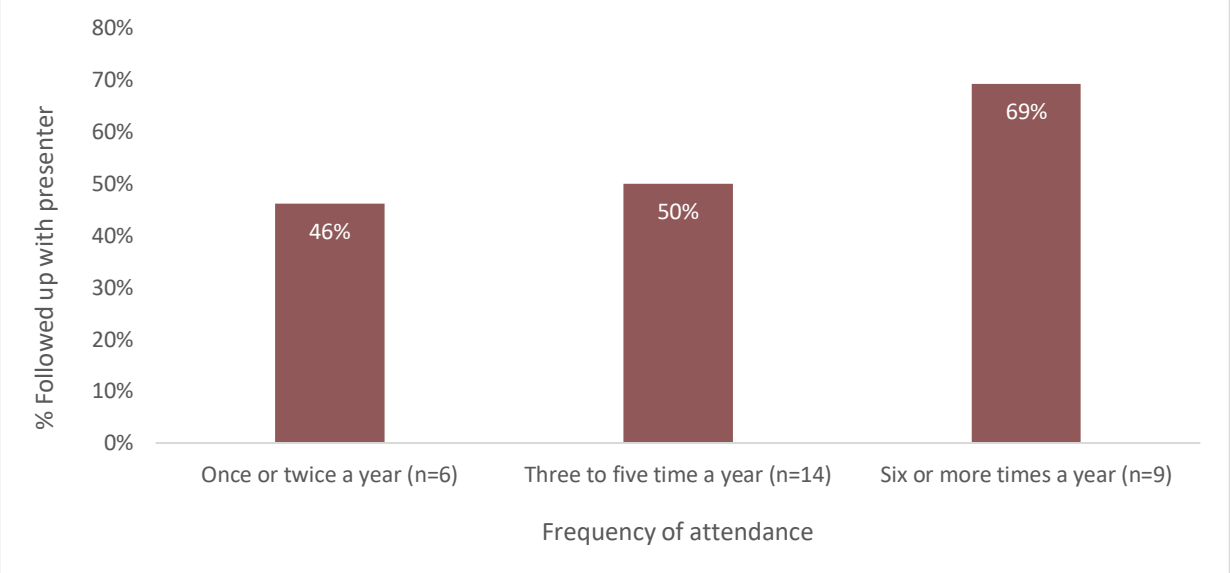

Figure 6-23 Follow-up with presenter by frequency of attendance

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Responses indicated that there was a gradual increase in follow-up with presenters as frequency of attendance increased. The following table shows the reasons for follow-up supplied by respondents, organised by frequency of attendance.

Table 6-2 Reasons for follow-up by frequency of attendance

	Once or twice a year (n=6)	Three to five times a year (n=14)	Six or more times a year (n=9)
To get more details about the research	33%	86%	89%
To share relevant experience	33%	0%	33%
To discuss a research point	0%	0%	22%
To get contact	17%	21%	11%
To discuss methodology	33%	14%	11%

	Once or twice a year (n=6)	Three to five times a year (n=14)	Six or more times a year (n=9)
To request the full paper	0%	7%	11%
To request collaboration	0%	14%	0%
To share own data	17%	7%	0%
To request expertise	0%	7%	0%

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Reasons for follow-up for those who reported attending six or more times a year appeared to focus on a deeper level of engagement with the research: requesting the full paper, discussing a research point, and sharing relevant experience. Those who reported attending only once or twice, however, included discussion of methodology and sharing of their own data and experience: an engagement beyond superficial. It seems likely that frequency of attendance had less to do with attendees' level of interest than with the inability to attend.

6.3.3 Sharing of learning

The act of passing on learning indicates engagement with the knowledge transmitted, and is itself an interaction that produces awareness, assumes relevance, and creates trust and understanding. Respondents were asked if they had shared what they learned at the Talks with others. The following Figure 6-24 illustrates the responses to this question.

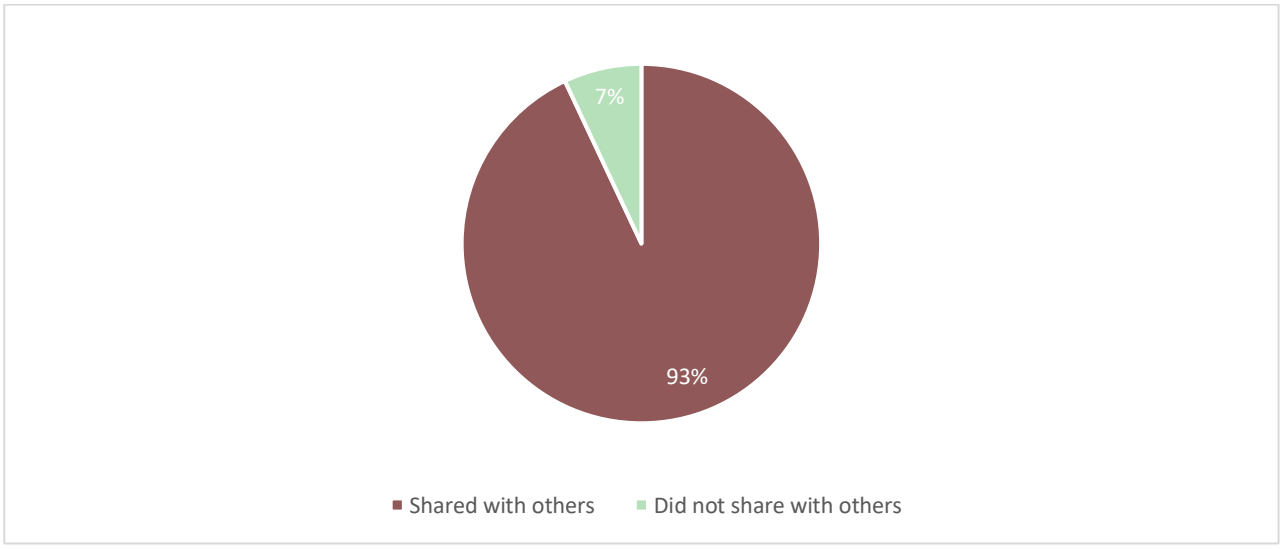

Figure 6-24 Sharing what was learned at Talks (n=56)

Most of the respondents (93%) reported that they had shared with others after the event. Figure 6-25 shows with whom the knowledge was shared.

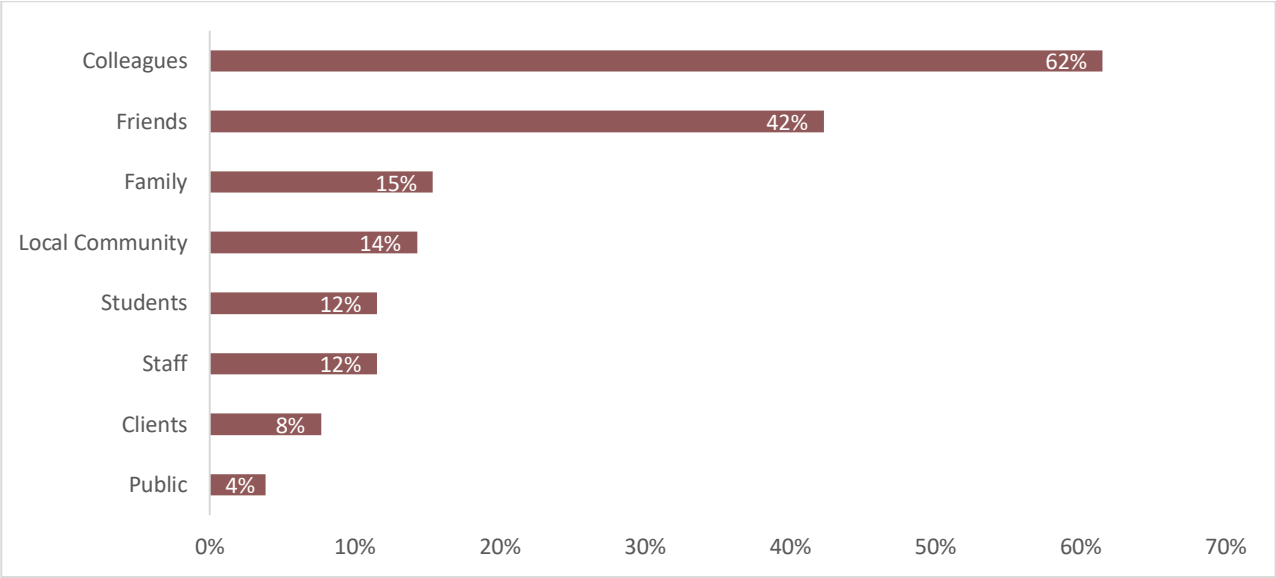

Figure 6-25 Others with whom learning was shared (n=52)

Most of the sharing reported was with colleagues (62%). This could indicate that the research had been perceived as relevant to the respondents' professional lives, especially in the case of tourism managers and the guides in their concessions, and for academic researchers and their students.

Some examples of sharing what was learned with colleagues at work follow.

> *"I shared it with other guides."* **[Tourism sector guide]**
>
> *"To all our staff at [name of company] at our Monday morning meetings and our concession managers."* **[Tourism sector manager]**
>
> *"My students and colleagues."* **[Professional researcher]**

Responses to this question did, however, also indicate incorporation of the learning from the Talks in social interactions not directly related to work. The following comments illustrate this.

> *"People who had missed the talk and were curious about what they'd missed."* **[Volunteer researcher at Botswana institution]**
>
> *"A number of friends and family related with Tourism Industry and some that are not involved at all."* **[Private sector manager]**
>
> *"Colleagues, customers, friends, family. Anyone I was talking to."* **[Private sector manager]**

Did engagement of one kind – sharing with others of what was learned - indicate that attendees were more likely to engage in other ways? Responses from those who indicated that they had shared what they had learned at the Talks with others were compared to those who reported that they had followed up with a presenter. The results of this comparison are shown in Figure 6-26.

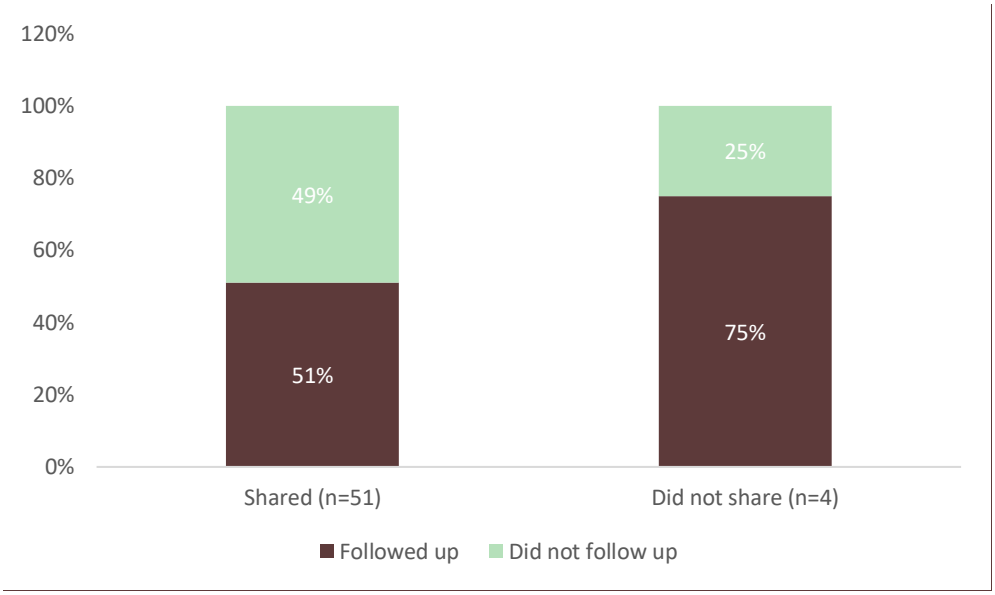

Figure 6-26 Follow-up and sharing

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

This comparison showed that about half (51%) of those attendees who had shared with others had also followed up with a presenter. But more (75%) of those who did not share with others, reported that they had followed up with a presenter, possibly indicating different functions for the types of engagement. The number of those who reported that they did not share, however, was very small.

6.4 Evidence of uptake of research by attendees

The survey data were compared to reveal any patterns that might be interpreted as the result of productive interactions, in that they led to effort by the stakeholders to engage with the research, either through changing their thinking and behaviour, or through use of the research findings.

Responses to the questions, *To what extent has exposure to the **presentations** at the event affected how you think, work or interact with the community?*, and, *To what extent has exposure to the **discussions** at the event affected how you think, work or interact with the community?*, were analysed to determine whether the two activities led to different outcomes.

Responses about five indications of uptake were analysed, relating the types of change or action reported to conceptual, instrumental, and strategic forms of uptake.

1) Changes in thinking (conceptual uptake)
2) Changes in how work is carried out (instrumental uptake)
3) Changes in interactions with members of the community (strategic uptake)
4) Use of learning at work (instrumental uptake)
5) Use of summaries shared post-event (conceptual, instrumental, and strategic uptake).

6.4.1 Effect of the Talks on attendees' thinking: conceptual uptake

First analysed were the responses related to a change in thinking: conceptual uptake that results in a change in opinion or understanding without necessarily leading to action. This kind of change is often where development of the shared repertoire of a community of practice takes place: concepts related to the research find expression in new vocabulary for what might have been previously observed phenomena among stakeholders.

> *"People from Cheetah Conservation Botswana they have talked about their wildlife guarding dogs and their general failure of translocations. I kind of knew that stuff, but it's nice to hear it all in a fifteen minutes chunk, so you have a reference point for it. They published a fair chunk of that, what it is in a way convenient is that a lot of people have heard it from the same source."* **[NGO researcher (RT005)]**

Some attendees who were not academic researchers reported that they felt there was a levelling of the playing field in terms of their ability to be respected when they asked questions or made comments during or following presentations. This suggests the conditions conducive for equitable exchange of knowledge that creates trust.

> *"I feel free … You're just interacting, you're gaining knowledge. And it's very fun, light-hearted, you don't all have to just sit, and are given opportunities to ask questions."* **[Tourism operator (RT014)]**
>
> *"There was one that really sticks in my mind, is [Consultant researcher] was talking about that baobabs and camel thorns where all the trees are and some woman asked how long it would take to replace a three thousand year old baobab? And he responded in a very polite way said, about three thousand years. No I don't think there has been any incident where, and there are some other questions have been like that where five consecutive seconds of rational thought would have …."* **[NGO researcher (RT005)]**

Which were more effective in bringing about conceptual uptake: researchers' presentations or the discussions that followed? Figure 6-27 shows a comparison.

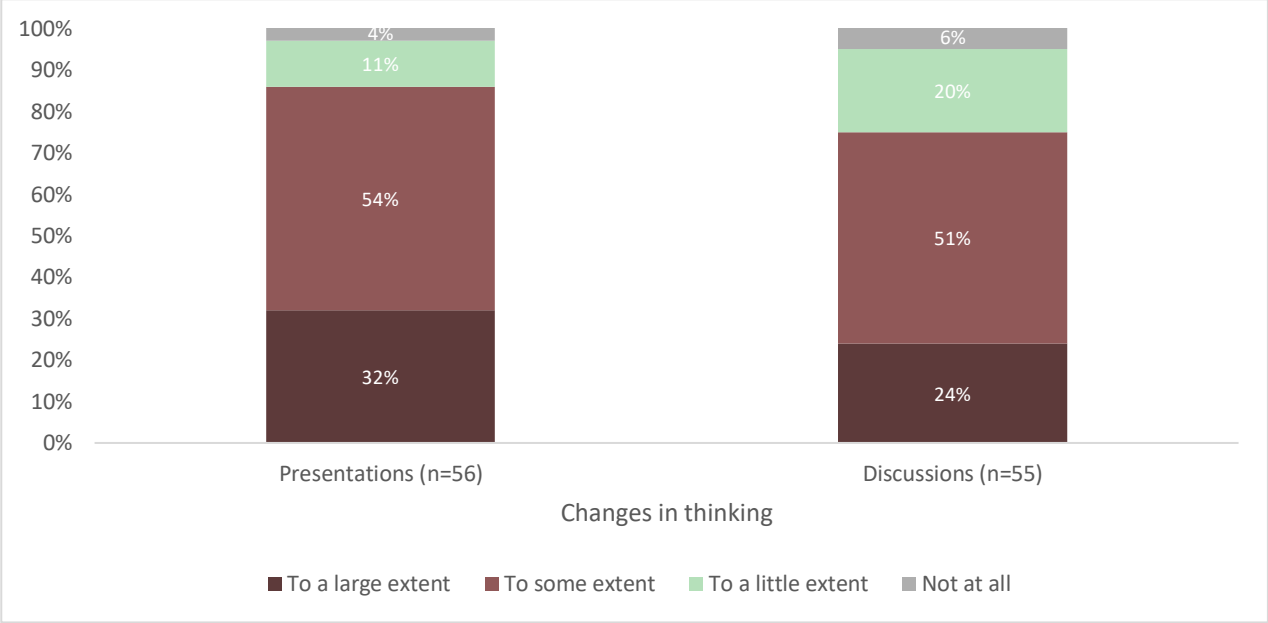

Figure 6-27 Comparison of changes in thinking as a result of presentations and discussions

Presentations appeared to influence attendees' thinking to a large extent slightly more than did the discussions (32% and 24%), and overall, presentations had slightly more influence on conceptual uptake.

To establish whether the organisational affiliation of the attendee was related to changes in thinking following presentations, survey respondents' affiliations were combined with their responses about changes in thinking, which were combined into two: large/some and little/none. The results of this are shown in Figure 6-28.

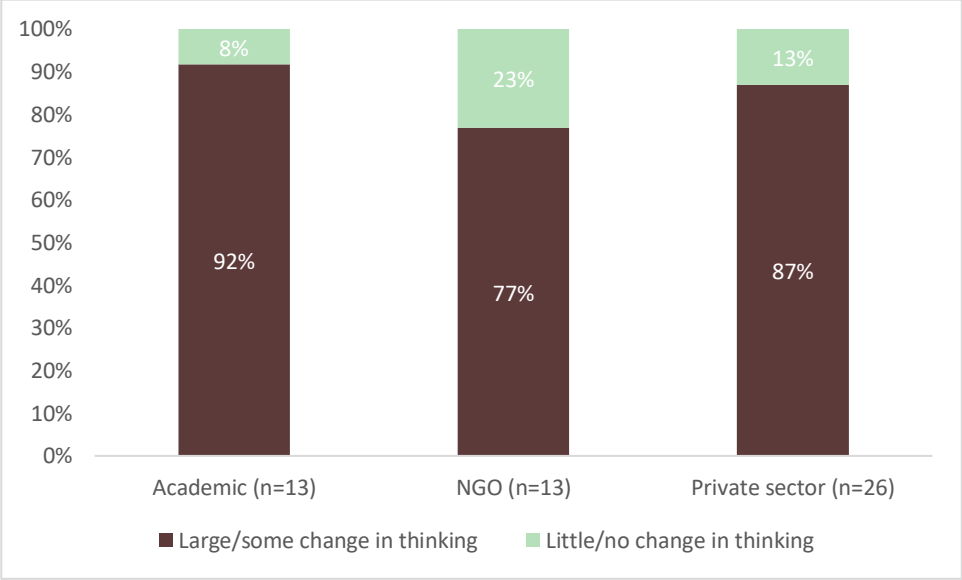

Figure 6-28 Changes in thinking about an issue because of presentations at Talks event, by organisational affiliation

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

The results of this analysis indicate a high level of change across organisational affiliations: a slightly higher degree of change of thinking among academic researchers (92%) than among private sector attendees (87%), followed by attendees from NGOs (77%).

Similarly, to establish whether the organisational affiliation of the attendee was related to changes in thinking following discussions, survey respondents' affiliations were combined with their responses about changes in thinking, which were combined into two: large/some and little/none. The results are shown in Figure 6-29.

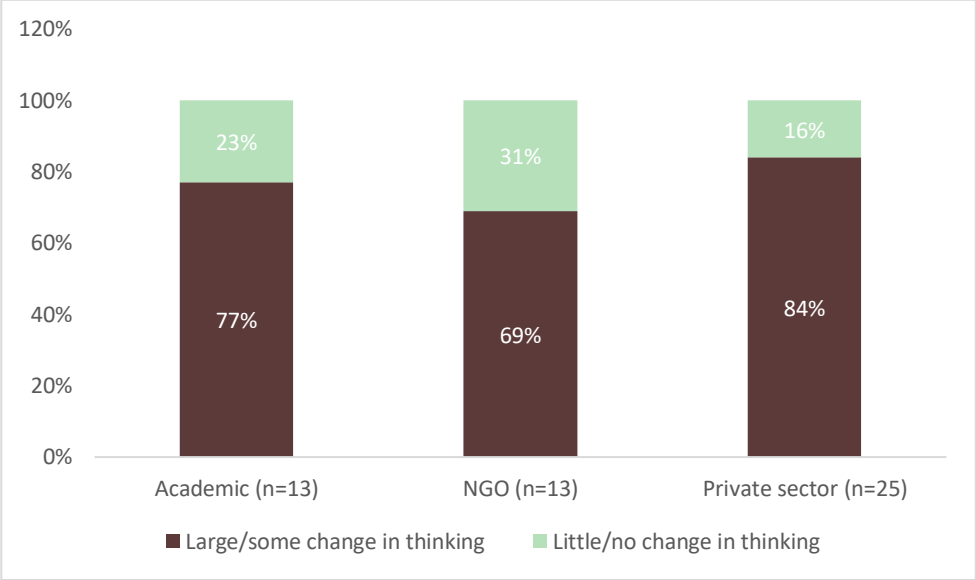

Figure 6-29 Changes in thinking about an issue because of discussions at Talks event, by organisational affiliation

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

6.4.2 Effect of the Talks on attendees' way of working: instrumental uptake

Next analysed were responses related to a change in the way that attendees worked, following their exposure to the presentations and discussions at the Talks: instrumental uptake of the research in the form of application in the workplace.

Were there changes in work behaviour of attendees following their exposure to new knowledge at the presentations and discussions? Figure 6-30 illustrates the answer to this question.

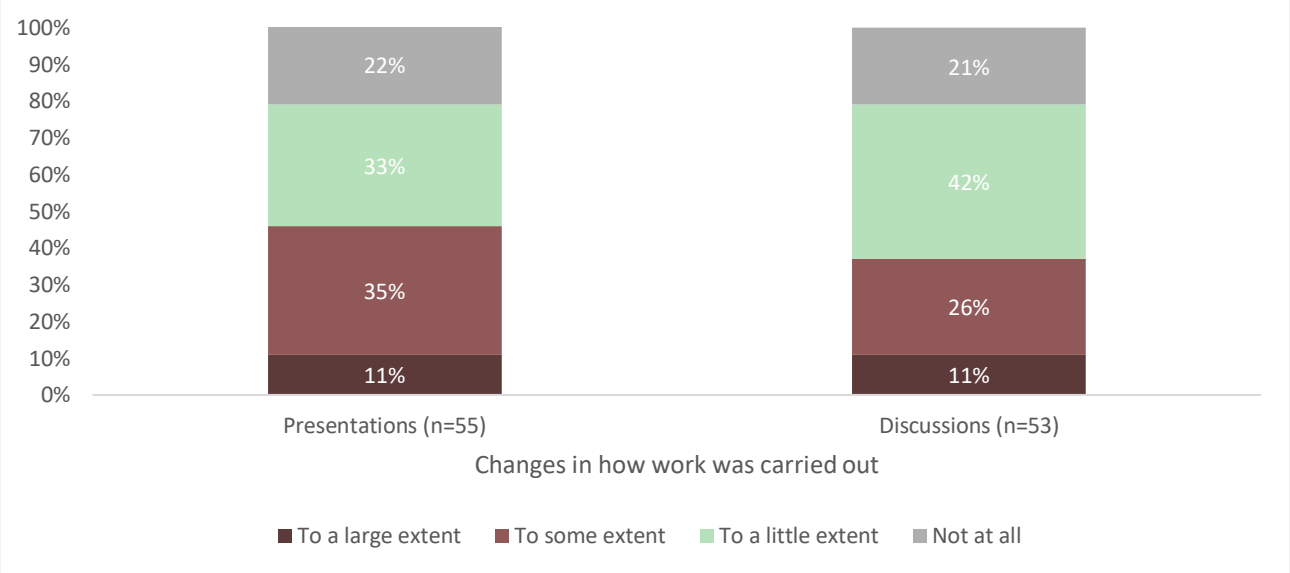

Figure 6-30 Comparison of changes in work behaviour as a result of presentations and discussions

Survey respondents reported little difference between the effect of presentations and discussions on the way they carried out their work, but responses indicated that there was some change in this area: 46% of respondents reported changes in how they carried out their work based on what they learned in the presentations, and 37% on what they learned through the discussions.

To establish whether the affiliation of the attendee was related to changes in way of working following presentations, survey respondents' affiliations were combined with their responses about changes in working, which were combined into two: Large/some and Little/none. Figure 6-31 shows the result.

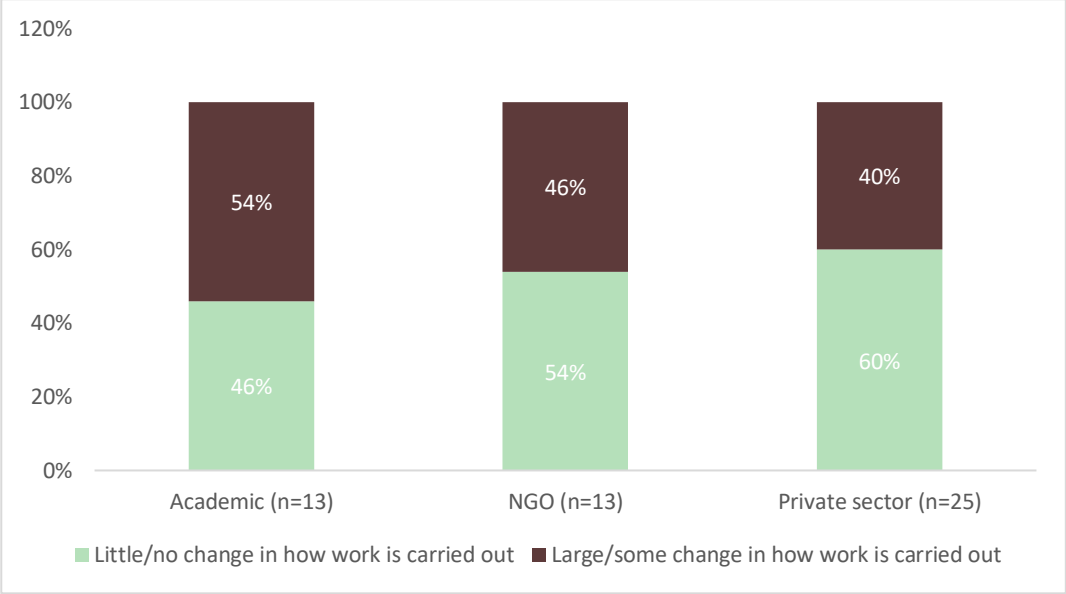

Figure 6-31 Changes in how work is carried out because of presentations at Talks event, by organisational affiliation

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Academic researchers reported the most change in way of working (54%), followed by NGO (46%) and private sector (40%) attendees.

Similarly, to establish whether the affiliation of the attendee was related to changes in way of working following discussions, survey respondents' affiliations were combined with their responses about changes in working, which were combined into two: Large/some and Little/none. Figure 6-32 shows the results of this comparison.

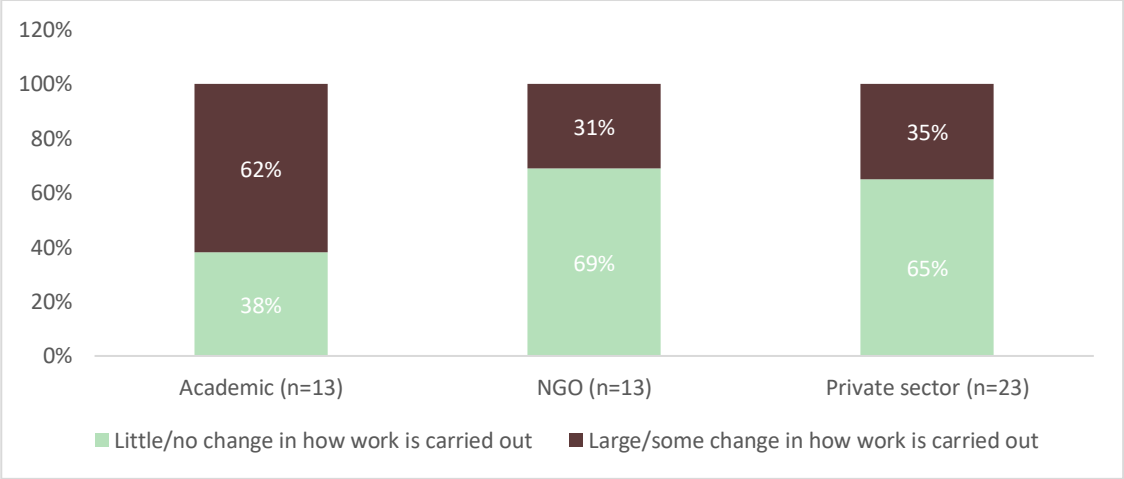

Figure 6-32 Changes in how work is carried out because of discussions at Talks event, by organisational affiliation

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Again, academic researchers reported the most change in way of working (62%). For discussions, however, private sector attendees reported slightly more change (35%) than did NGO (31%) attendees.

6.4.3 Attendees' interactions with others in the community: strategic uptake

Next analysed were responses related to a change in the way that attendees interacted with other members of the community, following their exposure to the presentations and discussions at the Talks. Such changes could be considered strategic uptake that uses the new knowledge as social capital to communicate with, or influence, others. Figure 6-33 shows the results of this analysis.

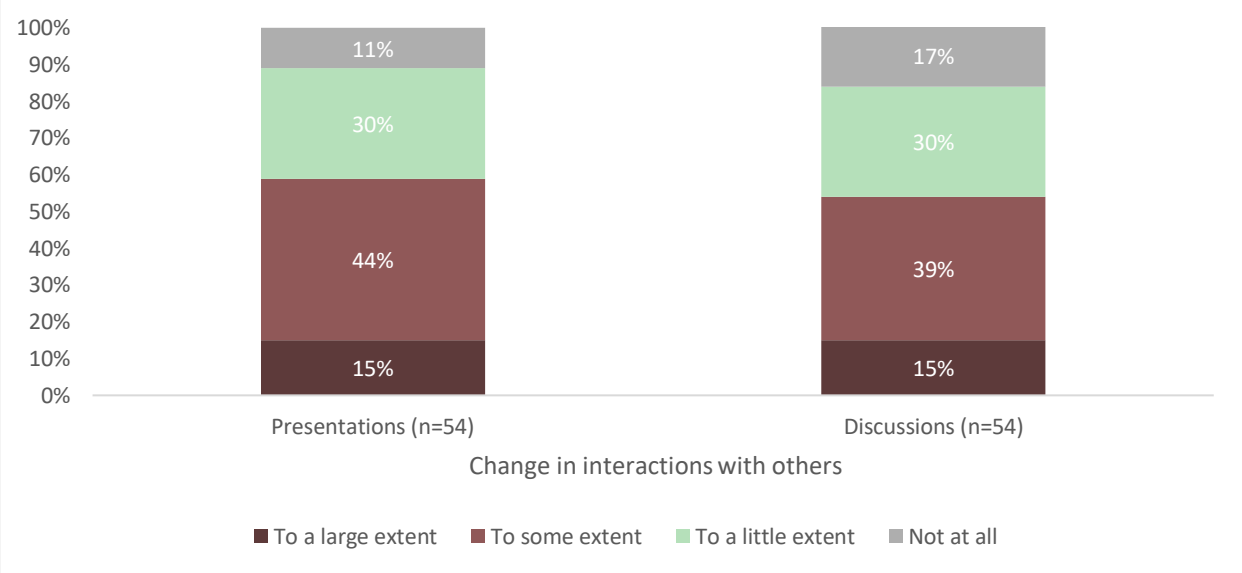

Figure 6-33 Comparison of changes in interactions with others in the community as a result of presentations and discussions

There was little difference between the effect of presentations and discussions on how attendees interacted with others in the community but, again, less than a quarter (11% and 17%) of responses indicated that these activities had no influence on their social behaviour.

To establish whether the affiliation of the attendee was related to changes in how they interacted with others in the community following presentations, survey respondents' affiliations were combined with their responses about changes in patterns of interaction, which were combined into two: Large/some and Little/none. Figure 6-34 shows the results.

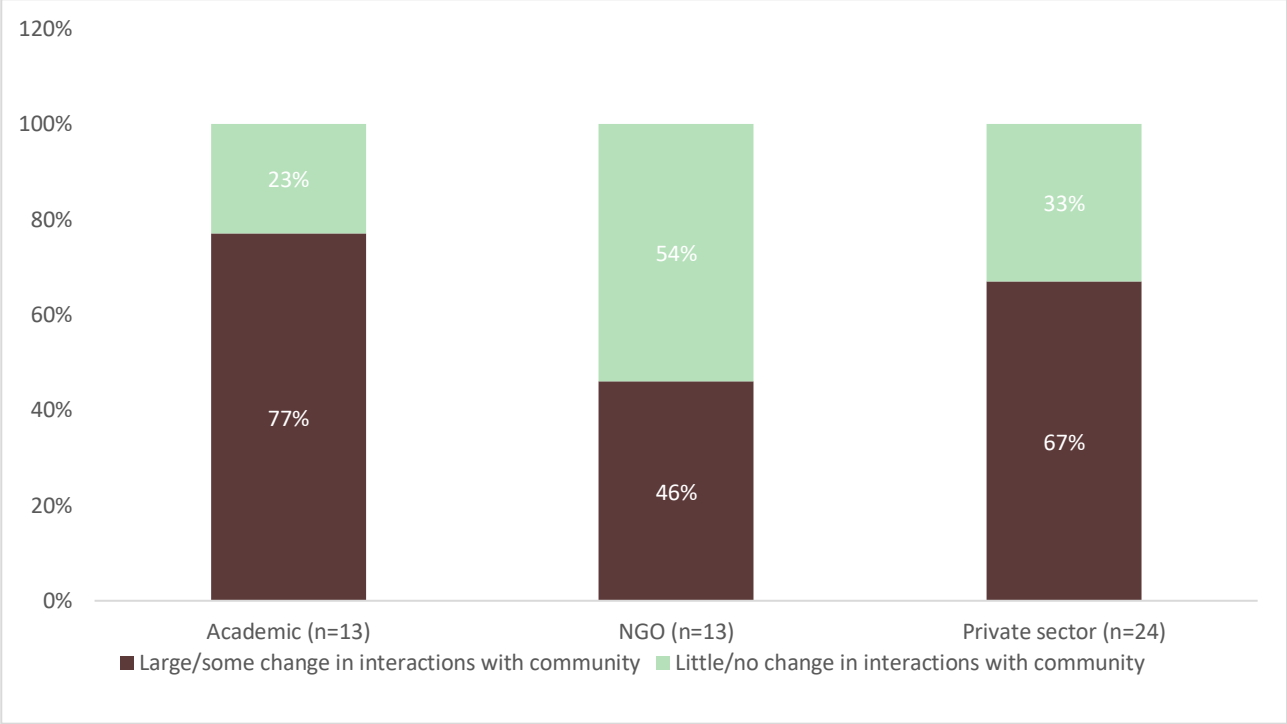

Figure 6-34 Changes in interactions with community because of presentations at Talks event, by organisational affiliation

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Here there was a noticeable difference between the responses of attendees from NGOs, about half of whom reported change at a rate of 46%, and those of academic researchers at 77% and private sector attendees at 67%. This could perhaps be because NGO workers have a social mandate that requires outreach as part of their core business.

Similarly, to establish whether the affiliation of the attendee was related to changes in how they interacted with others in the community following discussions, survey respondents' affiliations were combined with their responses about changes in patterns of interaction, which were combined into two: Large/some and Little/none. Figure 6-35 shows the results.

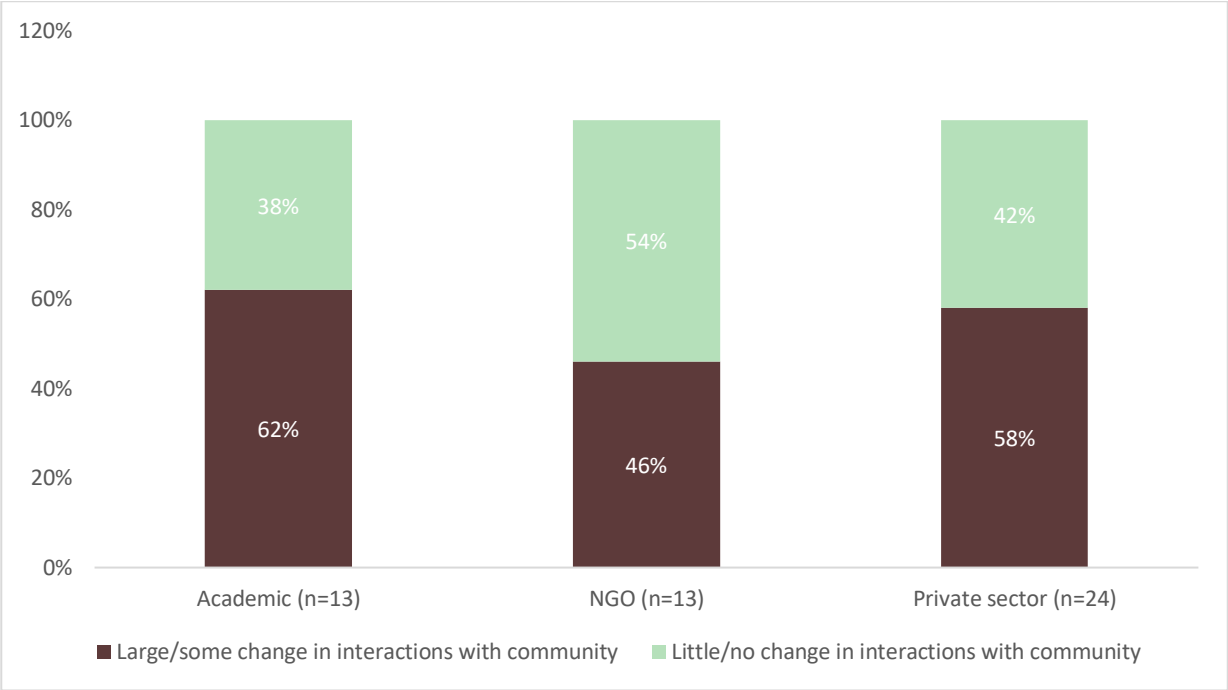

Figure 6-35 Changes in interactions with community because of discussions at Talks event, by organisational affiliation

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Academic attendees reported the largest change (68%) in terms of interactions with the community, following discussions at the event. Attendees from the private sector also reported more change than not (58%), while those from NGOs reported more (54%) that there had not been a change in their interactions with the community.

6.4.4 Use of research at work by attendees: towards instrumental uptake

The respondents were asked if they had used what they had learned at the Talks in their work, and the 23 who responded positively, were asked to describe how they had used the learning in their work through an open response. Thirty-five percent of those responding to this question reported that they had used what they had learned at work. Their responses were coded into the seven categories shown in column 2 of the following Table 6-3.

Table 6-3 Purpose of sharing

Type of use	Use of what was learned at work	Response
Conceptual	Contributing to understanding	*"I'm interested in the ecology and biogeochemistry of the Okavango Delta. I learned about different aspects of the ecosystems that apply to my own research."* *"I have incorporated the learnings into the way we work with women in their communities."* *"It's feeding my work with other points of view, new ideas or techniques. Make me think about other factors that could affect a certain situation. In general, it fed my overall knowledge."* *"sometimes in approaching a scenario, your outlook was changed."* *"streamlining personal interests"*
Strategic	Identification of collaborators	*"recognising gaps and opportunities for research, contact with potential collaborators"*
Strategic	Contributing to networking	*"Referred environmental teachers to particular researchers"* *"Part of my work is to create awareness about conservation research in Botswana via social media platforms. Some of the research talks have helped me find material to post on these platforms."*
Strategic	Sharing of knowledge	*"increased sharing of work done"*
Strategic, Instrumental	Improving business	*"I gave the information on to my clients."* *"Providing information to managers and guiding communities which in turn helps us to add more value to our guests and better protect the concessions we are responsible for."* *"Included some of the information when I talk to my Safari guests."* *"To better inform tourists/customers about issues in the delta and surrounding areas"*
Instrumental	Improving conservation	*"the methods of monitoring carnivores from spoor on the road and the ID of alien plants on the concessions"*

Type of use	Use of what was learned at work	Response
		"Used the same monitoring program as outlined … and also invasive alien control" *"In monitoring the movements and behaviour of animals in my area of operation"* *"I have tried to take further interest and explain invasive species and how they establish themselves in overgrazed areas"*
Instrumental	Application to research	*"Use of camera traps"* *"Changed research methodologies"* *"To improve on Research Methodology"* *"camera trapping techniques"* *"Try replicate the methodology"*

Some responses included more than one category. The greatest number of responses (48%) indicated that the attendees had applied what they had learned to other research, with the next highest use (35%) being contribution to understanding.

Was there a relationship between those attendees who used at work what they learned at the Talks, and whether they had followed up with a presenter? Figure 6-36 illustrates the combination of these two sets of responses.

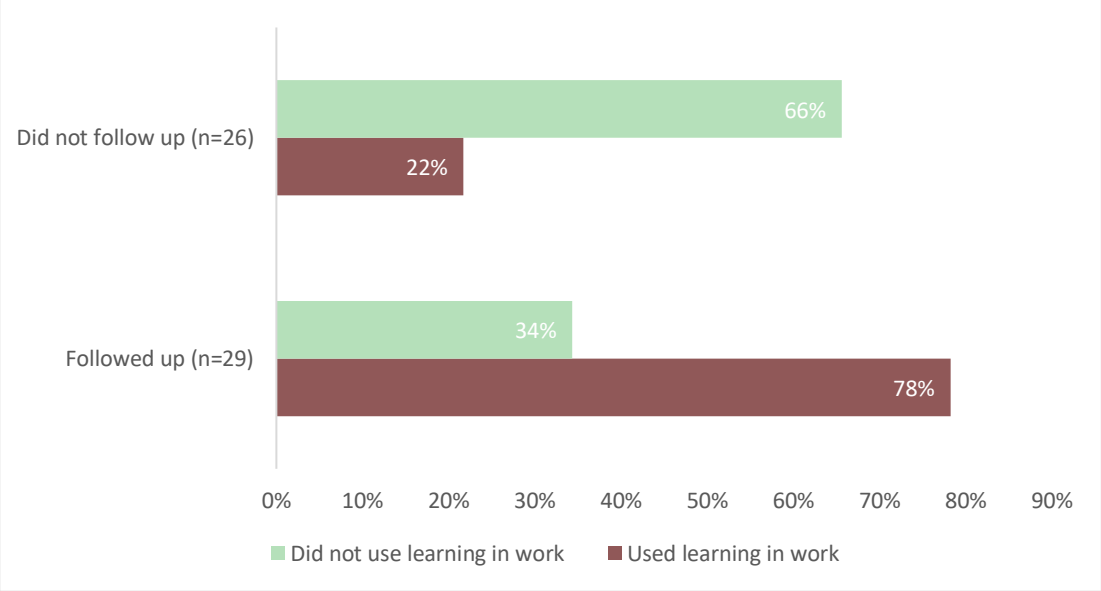

Figure 6-36 Use of learning at work and follow-up

The following statistically significant differences ($p<0.05$) were observed, according to a Bonferroni test for comparison of proportions:
"Followed up" (62% used learning in work) > "Did not follow up" (19 % used learning in work)
"Did not follow up" (81% did not use learning in work) > "Followed up" (38% did not use learning in work).

More than half (62%) of those respondents who reported using learning at work also reported that they had followed up with a presenter, compared with 38% who did not report use of the learning at work. Few (19%) of those who did not use the learning at work had followed up with a presenter. This suggests that direct engagement with researchers is more likely to lead to use of the research at work, including sharing with work colleagues.

Many of the survey responses indicated that learning from the Talks had been applied to data collection or field research methods, but there were also accounts of presentations and discussions at the Talks resulting in further interactions that benefitted both research and stakeholder work:

> *"It was [Academic researcher] I think who presented on lions and collaring then we had a big discussion after that about that collaring and the guides were saying, Why are you collaring, why? We had, I think, [Academic researcher], in the audience, so there were a few people who could chime in and basically just talk about it, and explain why, and I think it was after, it must have been a couple months after that one that then I got an email from, I think it was [Tourism concession holder], saying that we've got a collared lion in our area, whose is it, we want to find out more. And then I contacted the researchers and said, OK, they want to find out, and the researchers then visited the lodge and spoke to the guides about the lion, and then everyone knew everything."* **[Academic researcher (RT001)]**

Other responses from the survey showed that what was learned at the Talks also contributed to both better understanding of their work at personal level and stimulated further interactions. Examples of some of these are shown through the following comments.

> *"… sometimes in approaching a scenario, your outlook was changed."* **[Tourism sector manager]**
>
> *"It's feeding my work with other points of view, new ideas or techniques. Make me think about other factors that could affect a certain situation. In general, it fed my overall knowledge."* **[Graduate student from institution outside Africa]**
>
> *"Referred environmental teachers to particular researchers."* **[NGO manager]**
>
> *"To better inform tourists/customers about issues in the delta and surrounding areas."* **[Private sector manager]**
>
> *"Providing information to managers and guiding communities which in turn helps us to add more value to our guests and better protect the concessions we are responsible for."* **[Tourism sector manager]**
>
> *"Included some of the information when I talk to my Safari guests."* **[Tourism sector manager]**

June 7 - 14, 2019 OPINION/COLUMN

RESEARCH TALKS

Lessons from traditional land use and management institutions

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The high numbers of global users directly and indirectly depending on natural resources has exacerbated natural resource depletion, land

Growing social, economic and ecological problems imply that the world collectively has a duty to ensure that land and natural resources are sustainably used. Scientists' and planners' acknowledgement that science does not have all the answers has increased attention on traditional knowledge as a possible source for solutions. Botswana Government has expressed interest in incorporating traditional knowledge to strengthen and maintain the country's national economic, ecological,

traditional, rural, agrarian society to a secular, urban, industrial society and decades of stereotypes have gradually labelled traditional systems as outdated, irrational, complex, and difficult to implement worldwide. To enhance understanding of traditional knowledge, and the need to find appropriate local solutions, this paper dissects the components of traditional institutional arrangements by discussing who was involved in land use and management during the pre- and post-

district. It outlines the traits, hierarchy, roles, skills, communication channels and levels of arrangement of decision makers in land use and management. This approach demonstrates the relationship local people had with land in the past and the relevance traditional knowledge might have in the present. The various practical lessons that can be gained from the different traditional institutions include:(i) knowledge sharing, (ii) conservation strategies, (iii) ways to minimize vulnerability between generations, and

Figure 6-37 Summary of presentation published in local newspaper

Written summaries of the presentations are emailed to those on the distribution list following each event, and since 2018, reproduced in the weekly newspaper, *The Ngami Times*. This allows for potential indirect interactions. Respondents were asked if they used these summaries, and given three options: *No, I have never received the summaries; No, I have received the summaries but have not used them, and Yes (please explain how they were used)*. Figure 6-38 shows the shows the responses to this question.

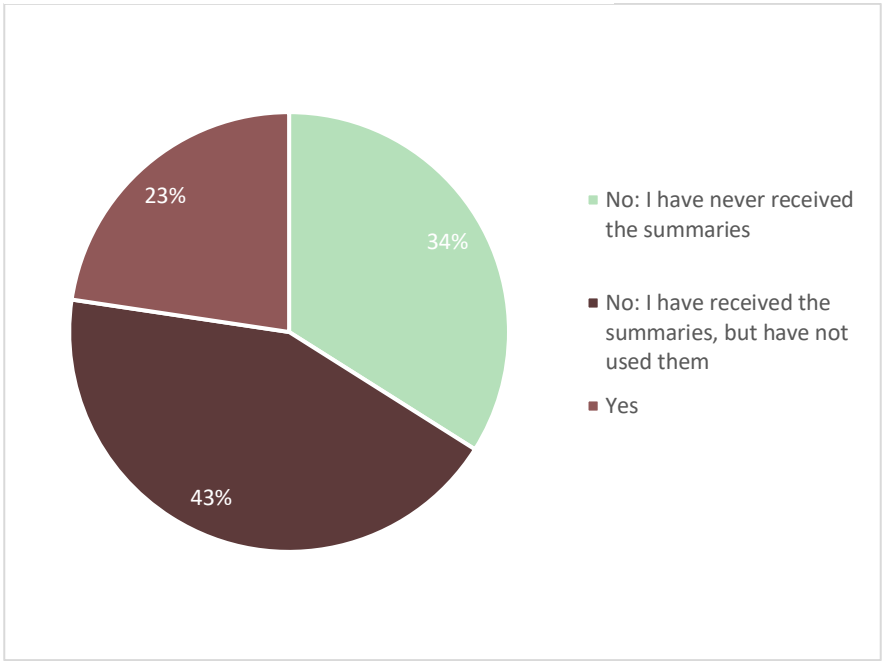


Figure 6-38 Whether summaries were used (n=53)

A negative response was supplied by 77% the respondents, but it is important to note that not all of these had received the summaries. Most (43%) had not used the summaries; 34% indicated that they had not received them.

Respondents were allowed to explain how the summaries were used, as open comments that were then coded into the six categories listed in Figure 6-39.

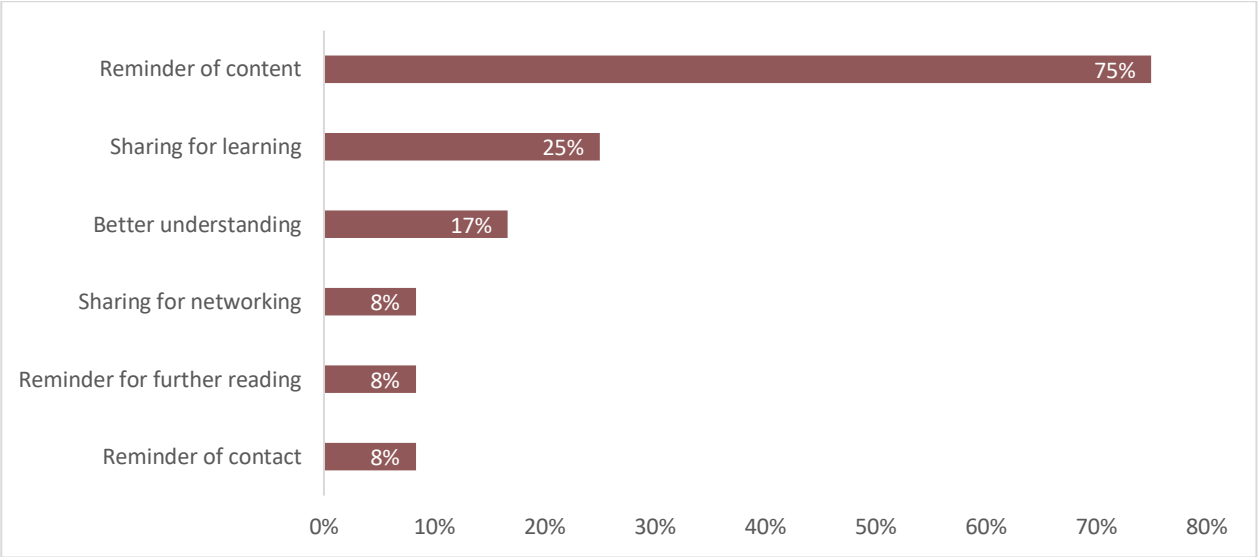


Figure 6-39 Uses of summaries (n=12)

Most of the responses to this question pointed to the summaries being kept as a reminder: an indication of conceptual uptake. More than a quarter of the responses indicated that the content of the summaries was shared with others, for either learning purposes (25%) or networking (8%). An indirect interaction in the form of the written summary led to a direct interaction in the form of a sharing event. The following comments provide some examples.

> *"I disseminate the printed summaries to the camp staff and guides. The guides really like getting that up-to-date information."* **[Tourism sector manager (RT004)]**
>
> *"I circulate to our staff at work."* **[Tourism sector manager]**
>
> *"I am using them in the new website."* **[Tourism sector manager]**
>
> *"Shared them with the staff and my other groups as learning points to enhance our work."* **[NGO manager]**

6.5 Discussion of findings

The responses documented in the preceding sections in themselves appear to often lead to more responses. The process diagram introduced at the beginning of this chapter can now be populated with the elements needed to realise productive interactions, and that contribute to a community of practice. Table 6.4 summarises these.

Table 6-4 Progression of interactions in relation to conditions for research uptake

Those without empirical evidence in the case study but for which an argument can still be made based on logic, or by making the implicit explicit
Those with empirical evidence that support the claim

	Interaction	Entities Involved	Conditions	Community of Practice Elements	Uptake
Pre-Event	Invitation/suggestion to speak	Organiser - researchers	Awareness *The interaction indicates or creates awareness of the event on the part of the researchers, and of the researchers' work on the part of the organiser* Trust *The acts of inviting and offering create acquaintance, and imply or build trust that the people involved, research, and the event are worthwhile and likely to enhance reputations*	Mutual engagement, Joint enterprise *Through the interaction, organiser and researchers have mutually engaged in joint enterprise: planning and production of event content*	
	Invitation to attend	Organiser-stakeholders, Researcher-stakeholder, Stakeholder-stakeholder	Awareness *The interaction indicates or creates awareness of the event and of the inviter on the part of invitees*	Mutual engagement *The invitation interaction represents a common negotiated activity*	Conceptual *Through the event programme or direct exchange with the inviter, invitees have already gained awareness of specific knowledge that they may not have had before*
	Attendance	All	Awareness *Stakeholders realise that the researchers and their research exist; researchers become aware of*	Mutual engagement, Joint enterprise *Through attending, stakeholders and researchers have*	

	Interaction	Entities Involved	Conditions	Community of Practice Elements	Uptake
			community interest. Acquaintances begin to be formed or are renewed.	*mutually engaged in the event as joint enterprise*	
Event	Presentation	Researcher-stakeholder	Understanding *Through listening and watching, stakeholders gain new knowledge or point of view*	Mutual engagement *Researchers and stakeholders have negotiated a common activity through delivering and attending to the presentation* Shared repertoire *Researchers have shared, and stakeholders become familiar with, new content and meaning*	Conceptual *Through the presentation, stakeholders have gained awareness of specific knowledge that they place in their personal or organisational knowledge structures*
	Discussion (Questions and comments from audience)	Stakeholder- researcher	Relevance *Stakeholders seek and find insights salient to their own experience and interests* Trust *Acquaintance is deepened through exchange and trust is created* Understanding *Both researchers and stakeholders achieve a fuller understanding of the research and of one another*	Mutual engagement, Shared repertoire *Through conversational exchange and sharing of experience, researchers and stakeholders begin to speak the same language to negotiate meaning*	Conceptual *Stakeholders and researchers gain further context and insight to add to knowledge gained*
	Social mingling	Organiser-stakeholder-researcher	Relevance *Stakeholders seek insights salient to their own experience and interests, and share experience*	Mutual engagement, Shared repertoire *Through conversational exchange and sharing of experience, researchers and stakeholders begin to*	Conceptual *Stakeholders and researchers gain further context and insight to add to knowledge gained*

	Interaction	Entities Involved	Conditions	Community of Practice Elements	Uptake
			Trust *Acquaintance is deepened through exchange and trust is created*	*use the same language to negotiate meaning*	Strategic *Stakeholders and researchers use knowledge gained to move their interests forward through further interactions and exchange*
			Understanding *Both researchers and stakeholders achieve a fuller understanding of the context of the research and of one another*		
Post-Event	Post-event follow-up with presenter	Stakeholder-researcher	Relevance *Stakeholders build on interest or perception of utility of research to reinforce relevance*	Mutual engagement, Joint enterprise, Shared repertoire *Through further exchange using common language and negotiated meaning, common interests are identified, leading to joint enterprise (We can do something together")*	Conceptual *Existing and potential context of research is further understood and internalised*
			Trust *Trust is demonstrated on both sides and deepened if follow-up is welcomed*		Instrumental *Potential use of the research in relation to joint enterprise is recognised*
			Understanding *Both researchers and stakeholders achieve a fuller understanding of the context of the research and of one another*		Strategic *Potential of the research to further individual or mutual interests is acted upon*
	Post-event sharing with others	Stakeholder-stakeholder	Awareness *Stakeholders who did not attend event become aware of the research*	Mutual engagement, Shared repertoire	Instrumental

	Interaction	Entities Involved	Conditions	Community of Practice Elements	Uptake
			Relevance *Stakeholder who shares reinforces relevance*	*Post-event exchange results in wider familiarity with research and the language used to describe it*	*Potential use of the research is clarified*
			Understanding *Stakeholders achieve a fuller understanding of the context of the research*		Strategic *Sharing stakeholder gains social status, advantage, or potential joint activity*
	Application at work	Stakeholder	Relevance *Stakeholder tests and reinforces relevance*	Shared repertoire *Stakeholder incorporates knowledge and language into practice*	Instrumental *Research is used in practice*
			Understanding *Stakeholder achieves a fuller understanding of the context of the research*		Strategic *Applied, research benefits reputation, supports forging of alliances*
	Engagement with summary	Organiser-stakeholder	Relevance *Salience of research reinforced*	Shared repertoire *Familiarity with language and meaning reinforced*	Conceptual *Inclusion of research in existing knowledge framework and worldview, reinforced*
			Understanding Repetition of encounter with research strengthens understanding		

Overall, findings of this study support the theory that productive interactions – those engagements that result in further engagement – build up to more uptake of research in a staged continuum of varied responses.

Reaching conclusions about the relationship of the outcomes of this process of engagement with the problem at hand – the effective management of wildlife and its habitat in northern Botswana – is challenged by the almost complete lack of participation in the studied event by an important stakeholder, the DWNP.

This thesis has looked at wildlife research in northern Botswana as contributing to a community of practice, characterised by Wenger's (Wenger, 1999) criteria of mutual engagement, joint enterprise, and shared repertoire (Morrison, 2014). Examination of selected research outputs, research permits, management documents, and interviews have indicated that the northern Botswana research stakeholders studied make up an identifiable community of practice, whose interactions produce resources that affect their practice. The findings of this study of the *Research Talks for Everyone* support those initial observations. The longevity of the event, the degree of positive interest expressed by attendees, and evidence of collaborative outcomes among the representation of research stakeholders who attend the Talks point to a loosely knit network or community that shares knowledge selectively, based on overlapping interests.

Longevity of the event could indicate that it addresses a communications gap or fulfils a social function. Participation in the *Research Talks for Everyone* event during the study period may be seen to indicate the importance of NGOs in both creation and brokering of research in the region, as representatives of NGOs and the students attached to them were active participants. Academic researchers were initially slow to engage but increased their participation as presenters over time. There was a noticeable absence of engagement by government stakeholders of research as either audience members or presenters. The Talks do, however, have a strong, local target audience, indicating the importance of research issues, especially those related to wildlife, to the tourism industry that provides the economic base for the region. The data collected also showed that while wildlife species research was the most presented topic, the content of these presentations was increasingly linked to landscape and socio-economic studies.

The results of the survey described in this chapter provide a positive indication that the stakeholders who attend the Talks – members of this community of practice - engage in productive interactions as result of participating in the event, and that these interactions, to some extent, influence the uptake or use of the research presented there.

Answers to the three questions explored through the findings of this study seem to indicate a positive response.

6.6 Do productive interactions take place through planned outreach activities such as public seminars?

The structured platform, *Research Talks for Everyone,* can be seen in itself as a productive interaction. The types of interaction observed and reported for the event fell mainly into the SIAMPI category of *direct*, meeting Tindal's criteria for corporeal co-presence, which, he argued, shapes the nature and outcomes of knowledge exchange events. The Talks did, however, embody all three types of interaction defined by the SIAMPI approach: **direct**, face to face exchanges among researchers and potential users; **indirect** exchanges through notifications and written summaries; and **financial** exchanges through the support for the event provided by Kwando Safaris. The event, and the other interactions it stimulated, led to uptake in the form of changes in thinking, use of the research and its methodologies through sharing for learning, and instrumental application in settings other than those of the original research.

The researcher responsible for organising the event began a series of interactions when she approached other researchers with a request to present, either in person or through correspondence. This led to changes in her relationships with other researchers, to building of new relationships, and to changes in her visibility and reputation in the extended community of research stakeholders:

> *"I think it also changed my standing in the community because I have been approached by several people with to saying "I want do this kind of research, or I want to find out - who do I talk to? so I'm finding people coming to me more outside of ORI."* **[Academic researcher (RT001)]**

Although potential attendees were notified by email and Facebook announcements, most of the respondents indicated that they had learned about the Talks through word of mouth, indicating a network of interested parties, and an initial direct, interaction related to the event.

For productive interactions to take place, there must be a mix of researchers and potential users - or stakeholders who are not necessarily full-time researchers. The largest groups of attendees at the Talks during the study period were NGOs and the private sector – many of these from the tourism industry. The core business of both groups was not research, although both groups from time-to-time supported research related to their institutional needs. This created a necessary condition for the exchange of knowledge.

The largest group of presenters who self-identified as both presenters and audience members consisted of graduate students. This indicates that knowledge was moving in more than one direction and confirms the role of the event as a site of learning. On the other hand, academic

researchers who were full-time staff at educational institutions were audience members more than presenters, indicating a low level of engagement as presenters by professional researchers in institutions other than NGOs. There is a participation gap in that the most experienced senior local researchers are not sharing their research through this channel. An explanation for this was offered by a professional researcher who had attended the Talks as both presenter and audience member, and who reported that an important reason for his own participation was to learn about what other researchers were doing in the region:

> *"Direct communication between scientists is very poor and always has been. Partly because people are competing for the same small pot of funding, and the same small pot of research permits and so on and so on, and it's sometimes empire building…. It's competitive when it should be collaborative. … They are paranoid about secrecy because they think they are going get scooped. … [That isn't so] because people don't work on the same subject, it can happen by terrible bad luck, but it's another reason why researchers need to know what other researchers are doing, so then there is less chance of anybody being scooped."* **[NGO researcher (RT005)]**

The formal question session following individual presentations frequently resulted in discussions where audience members shared their own experience, and sometimes questioned the motivations and conclusions of the presenters. This demonstrates a levelling of the knowledge playing field through the multi-directional flow of knowledge, a condition identified as important in equitable interactions:

> *"Considering that we are dealing with a broad range of experience and education, people are respectful and listen. Sometime though, the mark is missed. There was one presenter who was speaking about managing cattle in wildlife areas. He had the most complicated slide I have ever seen – full of diagrams and links, and he used a lot of jargon. He also over-ran his time. At the end of his talk, the finding was that if people kept their cows in kraals overnight there would be fewer losses to predators. One of our guides, [Name withheld], was sitting behind me, and I could tell he had been baffled throughout the Talk. But when the researcher came up with this conclusion, he just laughed out loud. All that work to discover what local people had been doing for thousands of years."* **[Tourism sector manager (RT004)]**

Explaining scientific research in language understandable to non-scientists is also an important part of levelling the knowledge playing field and leads to the shared repertoire that identifies a community of practice. Some survey respondents mentioned that presentations with too many slides and too much text, especially those made by students at the Okavango Research Institute, were not understandable, and this was echoed in follow-up interviews.

> *"I think people are quite willingly asking questions, querying some things. Also with most of them in their presentations succeeded in making it appropriate for the audience, some of them not so well as others, but I think all of that helped to have interactions constructively happening there."* **[Consultant (RT012)]**

> *"... not all the Talks I attended were pitched to a general audience. They used language that even I as a researcher found difficult to understand. So the opportunity was there, but the talk was too complex to allow understanding. It needs to be pitched at the right level."* **[Tourism sector manager (RT014)]**

The types of interactions observed and described in this study included audience members following up with presenters and sharing by attendees of what was learned at the Talks.

6.6.1 Follow-up with presenters

Most audience members followed up with presenters after the main event to ask more questions, to get contact details, request collaboration, share experiences, request expertise, discuss a point or methodology, share data, or request a copy of the full paper.

The largest group of those who followed up with presenters was made up of attendees who considered themselves audience members only. Respondents who were affiliated with NGOs reported the most follow-up with presenters, followed by those from the tourism industry. This indicates a lack of reservation on the part of many non-academics to engage with experts: a condition for equitable interactions. Professional researchers who were staff members of institutions, however, were not part of this group: they reported seldom following up with presenters. This indicates a lower level of engagement, a reluctance perhaps caused by fear of competition or criticism, although another reason might be because these researchers knew they had other opportunities in professional settings to engage with the presenters and their research.

There was an increase in the follow-up with presenters as frequency of attendance increased. This seems to indicate that more exposure to the event caused attendees to feel more comfortable with engaging with the presenting researchers, thereby opening channels for more interactions.

> *"I think only the initial - if it's their first time coming and, perhaps the initial question, they might not want to break the silence, but once one person has asked a question, you then see more people thinking, Ooh, it's OK to question, and generally people want to ...."* **[Academic researcher (RT001)]**

6.6.2 Sharing what was learned

Sharing what was learned at the Talks appears to be an important function of the event, as most attendees passed on something of what they learned at the Talks to others. Most of the sharing reported was with colleagues, which could indicate that the research had been perceived as relevant to the respondents' professional lives, and there was a positive relationship between sharing of the research knowledge and its use at work. Direct engagement with researchers appeared to be more likely to lead to use of the research at work, including sharing with work colleagues.

Since some sharing was carried out through more formal communications channels, as in the case of presentations picked up by the local newspaper (RT001), or for further dissemination through weblogs (6852802700, GP Email communication, 5 July 2019), further use of the research communicated in this way remains undetermined.

Engagement appears to lead to more engagement, including sharing, by attendees from all affiliations, including researchers, who over time were more willing to share their own research at the event. Ongoing exposure to the event was important for opening up communications among attendees. Even the indirect interaction of sharing of written summaries of presentations post-event led to further sharing, as in the case of the government official who requested more information after reading a summary, and of the tourism operators who redistribute the summaries to their camp staff.

When mapped against the process diagram, the boundaries become blurred, especially in the case of knowledge sharing, which, as a productive interaction, becomes in itself a form of uptake.

6.7 Do the interactions lead to change in thinking and behaviour?

Exposure of the audiences to the research through presentations and discussions did result to some extent in changes in thinking and behaviour. Changes in thinking through increased reflection was the form of uptake most reported as important by event attendees, but it did not necessarily result in acceptance of the research:

> *"The Talks have heightened my awareness of the world of academia, not always positively. To some degree I have become more cynical, because sometimes the research seems to be of dubious value. For example, there was one lady who found that poaching was more likely to occur near a border or a tar road. When you think of the time and effort involved in coming to that conclusion, you wonder."* **[Tourism sector manager (RT004)]**

Participation in the Talks also resulted in reflection that did not necessarily involve thinking about the scientific content of presentations:

> *"I have attended more than one evening .... The variety of topics and the variety of presentation styles encourages me in my 'narrow' sphere of work, i.e. I am not the only one passionately focused on something very specific! And there is room for humour."* **[Volunteer researcher at Botswana academic institution]**

While changes in behaviour at work also took place, there was little evidence that exposure to the Talks resulted in changes in the way that people interacted with others in the community at large, except for providing a topic of conversation in social situations (RT0010). The benefits of engaging with the research appear to be perceived at an individual level: beyond creating opportunities for personal reflection, if interactions related to the event led to application of the research or to business activities, this was usually directly related to the professional life of the attendee involved.

6.8 Do the interactions lead to research use?

What is learned at the Talks is being used by attendees at work to inform colleagues and staff, to apply new methods, and to make networking connections. This also applies to the use of summaries distributed post-event, where an indirect interaction in the form of the written summary led to a direct interaction in the form of a sharing event.

Some interactions at the Talks resulted in collaborative activities, either through application of the research methodology in other settings, or through requests to researchers to share their work further. Even though it is clear that the Talks have led to some instrumental use, perhaps the strongest argument for the interactions related to the Talks leading to uptake and use is based on the event's function as a learning environment. Learning and broadening knowledge were motivations most reported by survey respondents, and mutual learning – uptake of new knowledge by both researcher presenters and audience members –was observed throughout the Talks.

Lehr et al.'s (2007) conditions for events as 'sites of learning' and Tindal's (2016) for knowledge interaction (2016) were evident in the Talks. Table 6-5 provides an outline of these.

Table 6-5 Lehr et al. and Tindal conditions met by case study

Function	Application to Case Study	Evidence
Promotion of collaborative talk (Lehr et al.)	Questions and answer sessions led to further discussions among researchers and other stakeholders, both at the event and later, and some resulting collaboration was reported	Survey results, interviews
Enhancement of equitable interactions (Lehr et al.)	Question and answer sessions observed were inclusive, with little evidence of deference on the part of audience members to researchers' élite' status	Interviews

Function	Application to Case Study	Evidence
Development of new or different understandings or knowledge (Lehr et al.)	Better understanding reported	Survey results
Enhancement of interest and engagement in controversial science-based issues in society (Lehr et al.)	High level of interest indicated by Talks attendees	Longevity of event, survey results, interviews
Supporting networking (Tindal)	Encounters and new relationship reported	Survey results, interviews
Mutual learning (Tindal)	Collaborative outcomes reported	Survey results, interviews
Enabling of co-construction of knowledge through multi-directional exchanges (Tindal)	Multi-directional exchanges through Q&A, discussions, follow-up observed and reported	Survey results, interviews
Creation of opportunities for reflection (Tindal)		Survey results, interviews

Findings of the survey and follow-up interviews provide evidence that the event resulted in mutual learning, provided opportunities for reflection, and supported networking – three of the results that Tindal had observed in his study of a similar event, and argued were indicators of productive interactions.

The Talks also met conditions identified by Lehr at al. (2007) as the markers of events as 'sites of learning': the promotion of collaborative talk, enhancement of equitable interactions, the development of new or different understandings or knowledge, and enhancement of interest and engagement in controversial science-based issues in society.

If meeting these conditions shows that learning was taking place as a result of the Talks, then many of the interactions related to the event could be considered productive and leading to uptake and use.

6.9 Contribution to wildlife management in northern Botswana

The level of engagement of attendees with the research presented at the *Research Talks for Everyone* points again to the existence of a community of practice related to wildlife research in the region, in which a cross sectoral group of practitioners and researchers exchange knowledge through productive interactions. These interactions can be viewed as contributing to conditions that are understood to nurture research uptake: awareness, access, relevance, trust, and understanding.

- Lack of awareness of, and access to, research was the primary motivation for creating the Talks. For the northern Botswana community of practice, there is now an ongoing forum for public sharing of research.
- Content of the presentations at the Talks showed an increasing emphasis on social conditions that affect wildlife management, reflecting a larger shift from strictly biological studies to investigations of human-wildlife interactions and socio-economic issues. The research presented, then, speaks to societal relevance and applicability to management practice.
- Personal interactions at the Talks, some of which have led to collaborative work, have built more trust through enabling joint effort and creating understanding of what sometimes has been viewed as obscure science.

Increased communication among wildlife research stakeholders, however, did not extend noticeably to the main steward of wildlife in the region, the Botswana Department of Wildlife and National Parks (DWNP), because representatives of the government seldom attended. While the department, in theory, should be aware of ongoing research through the permit system, and through workshops organised by government, NGOs, and academic institutions, this is not always true on the ground. Absence of government representatives at the Talks also means that they are not actively adding their voice to the discussions generated by the event and engaging in follow-up that can lead to more uptake.

Overall, *Research Talks for Everyone* can be considered itself as a productive interaction, in that the event has led to further engagement with the research presented.

The contributions of activities and interactions associated with the event, when mapped through a process diagram, can be seen to follow a progression that could lead to uptake of the research.

As Davies et al. (2008) and Tindal (2016) pointed out, research uptake related to this type of event is frequently understated because it is mainly in the form of learning, and often occurs among individual people, rather than in the policy arena. Rather than considering them strictly channels of instrumental application of the research shared, such events can be considered creative spaces of knowledge exchange, where ideas are shared, setting them up for later reflection, and sometimes, application in lives and work spaces.

Next, Chapter 7 also considers the nature of interactions between researchers and other stakeholders of research, but through published outputs that are meant to share research findings, and with the aim of discovering uptake through capacity-building.

Chapter 7 Exploring theses and dissertations as proxies to investigate research-stakeholder interactions and uptake

7.1 Introduction

Interactions between researchers and those who might put their findings to use are not routinely recorded as part of accepted academic practice. This chapter examines the potential of several sources of documentation that might be used as proxies to investigate these types of interactions and their utility in indicating the productive interactions that may lead to research uptake and use. One of these sources is the written acknowledgements of people and institutions who assisted researchers in production of their findings. Another is citations of the research in dissertations and theses, which indicate a process of capacity building. These are explored, using as a starting point, responses to the survey of research permits described in more detail in Chapter 5, and dissertations and theses produced by students who participated in Botswana wildlife research under MENT research permit.

7.2 Acknowledgements as evidence of researcher–stakeholder interactions

> *"Scholarly texts emerge from webs of social relationships"* (Cronin, 2005).
>
> •••
>
> *"I will start* [in my acknowledgements] *with my good friends, mentors, and teachers who first walked me through Kalahari, taught me to appreciate the subtleties of the desert, and showed me how to see the world differently".* **(Academic researcher, [170])**

One possible source of information about interactions between researchers and stakeholders who might engage with their research is the written acknowledgements researchers give to people and institutions that have supported and assisted their work. An acknowledgement of this kind can be considered documented evidence of an interaction, and, possibly, of the strength and importance of the interaction.

Scholars' acknowledgments have been studied as they shed light on what is referred to as the 'invisible college': the network of researchers who, in the background, shape the development of new knowledge. Most studies have looked at acknowledgements as potential indicators of academic value and success in a similar way that bibliographic citations are used (Desrochers, Paul-Hus, & Pecoskie, 2015). The emphasis in many of these studies has been on acknowledgements of other researchers and institutional funders as contributors to trusted assessment, rather than on recognising the contribution of entities outside academia (Finnell, 2014; Hubbard, 2020). Cronin (2005) took a broader view, pointing out the importance of "social and locational" (Cronin, 2005, p. 8) links, often present in acknowledgements, that shape the interactions – and by extension, new

knowledge – of researchers. Recognition of a northern Botswana wildlife research community of practice (social), with interactions taking place in a unique setting of dryland and wetland wilderness (locational), might be viewed in this context.

A researcher who completed her thesis about natural resources use in northern Botswana posed the following set of questions:

> What does it mean to 'give back' to the communities within which we conduct research? How do we thank people not only for their time but also for their contribution to our academic advancement and, more fundamentally, to our own livelihoods? It is the stories and data points of numerous individuals that enable us to obtain graduate degrees and advance our careers. What sort of token of appreciation could possibly be commensurate to what colleagues, friends, and subjects in the field give us? (Gupta, 2014, p. 1)

In Gupta and Kelly's collection of essays (2014), Diver and Higgins explored the idea of *dynamic reciprocity*, "an ongoing practice of exchange for mutual benefit between academic and community research partners" (Diver & Higgins, 2014, p. 2), and, with other scholars, pointed to the need to recognise the contribution of interactions between researchers and the people occupying the spaces of investigation, to "… help us as researchers produce knowledge that can transform and broaden the impacts of our research" (Gupta & Kelly, 2014, p. 9). Kaplan et al. (2020) pointed out the "highly asymmetric interdependencies" that form a barrier to adequate acknowledgement of research contributions that are an essential element of ethical research practice (Kaplan, Kuhnt, & Steinert, 2020, p. 2). Toomey (2015) claimed a role for written acknowledgments in this process of recognition, a process that helped to balance power relations between researchers and the people who could be considered stakeholders of the research (Toomey, 2015, p. 91). This reciprocity is dependent on local awareness, relevance of the research to local needs, and on development of trust and understanding among the stakeholders of research[28].

Viewing acknowledgements as evidence of social interactions and intellectual influences that extend beyond normal academic practice to include research stakeholders is the focus of this section. It asks the question, *Do acknowledgments accurately reflect productive interactions?* If so, acknowledgements can function as proxies for productive interactions that point to uptake and use of the research. To examine this question, responses to several specific questions dealing with acknowledgements and uptake in the survey of research permits administered by Botswana's Department of Wildlife and National Parks between 1996 and 2014, and acknowledgments documented in dissertations and theses produced under the permits studied, were compared.

[28] While much of the research studied in this thesis has focused on wildlife and wilderness, it is no longer possible for most ecologists and other natural scientists to carry out their fieldwork in Botswana without taking human factors into consideration.

7.2.1 Acknowledgements reported by survey respondents

The research permits survey asked who researchers acknowledged when writing up the results of their research, providing them with seven options and allowing them to name others in an open-ended response. For analysis, these were coded into the 20 categories represented in Figure 7-1.

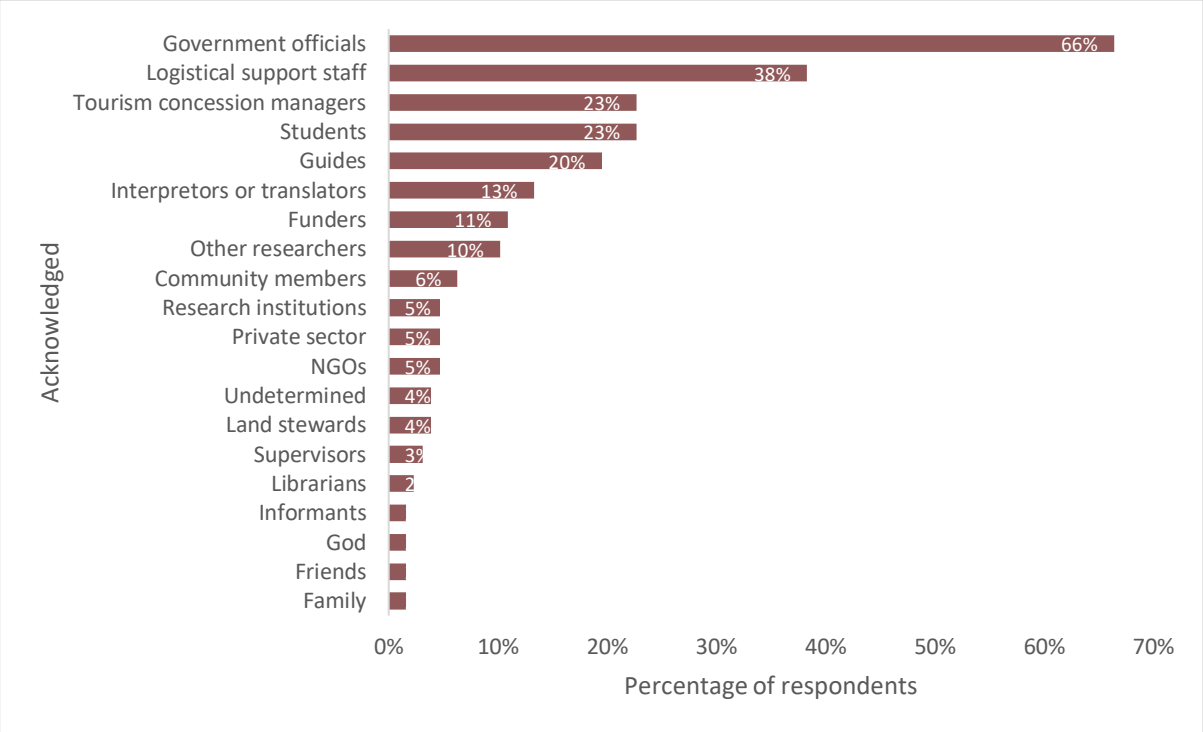


Figure 7-1 Supporters acknowledged by researchers in written up findings (n=128)

Close to 70% of survey respondents indicated that they had acknowledged others when writing up their research findings. Government officials were by far the most mentioned (66%), followed by logistical support staff (38%). Combining functionally similar categories, i.e. logistical support staff with guides and interpreters/translators (together 72%), and tourism concession managers with private sector and land stewards (together 32%), seems to indicate that gratitude was focused mainly on access to, and exploration of, locations and resources in the field. Some examples of this are found in the following excerpts from selected acknowledgements:

> *"Managers and owners of private rhino populations*." **[Student at South African university]**
>
> *"Community members."* **[Professional researcher at NGO]**
>
> *"Owners of the farm where the research was conducted,* [Name of local NGO] *staff, staff of the farm, my supervisor,* [Names of funders]." **[Student at institution outside Africa]**
>
> *"We acknowledged the Botswana Department of Wildlife and National Parks and [name withheld: owners of the study site]."* **[Professional researcher in institution outside Africa]**

Comparison of the survey responses by researchers who held their permits at the time as students, or as professional researchers, however, show some interesting differences (Figure 7-2).

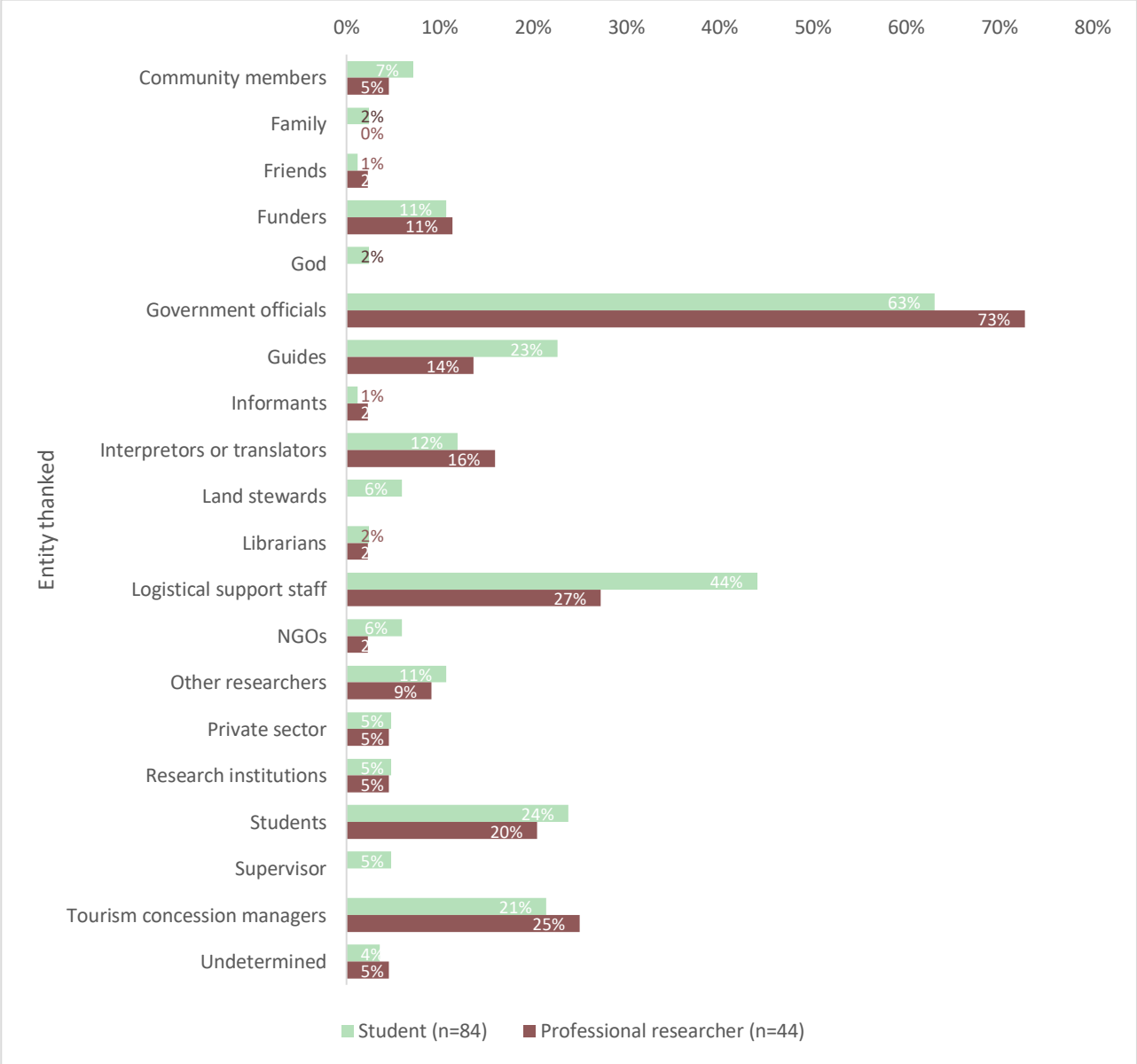


Figure 7-2 Entities acknowledged by students and professional researchers

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Professional researchers acknowledged government officials more often (73%) than did students (63%), while students were more grateful to logistical support staff (44%) than were professional researchers (27%). Furthermore, when compared with responses to the survey question about who was *most* influential in the success of their fieldwork, the responses, shown in Figure 7-3, varied.

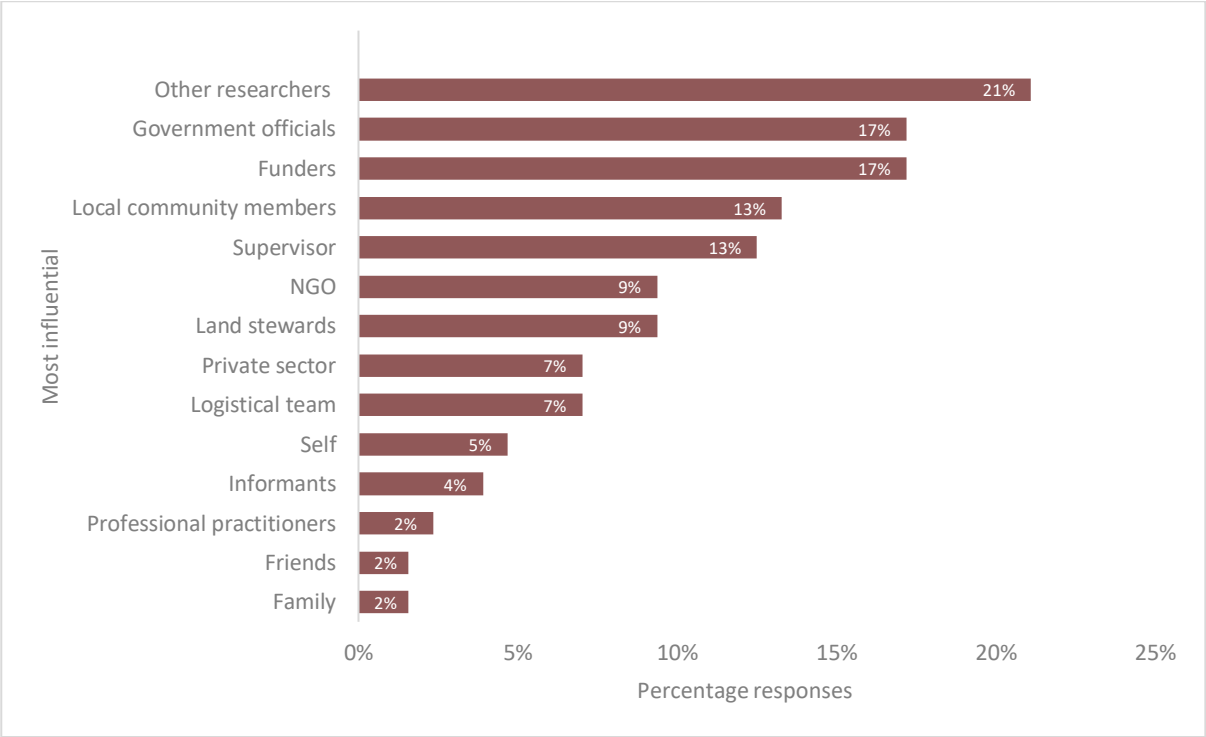


Figure 7-3 Most influential in success of fieldwork (n=128)

Only government officials (17%) were recognised as important in the top five positions in the responses to both questions. This is perhaps an indication that their frequent mention in acknowledgements represents more than *pro forma*, or courtesy, inclusion, as their role in issuing a permit for the research is so important.

7.2.1.1 Relationship of survey acknowledgements to reported interactions

To relate acknowledgements to interactions of researchers with stakeholders in the field, survey responses to the question about acknowledgements were compared with responses to questions about the interactions of the studied researchers, using the three stakeholder categories of government officials, community members, and NGOs. The following Figures 7-4 to 7-6 show the results.

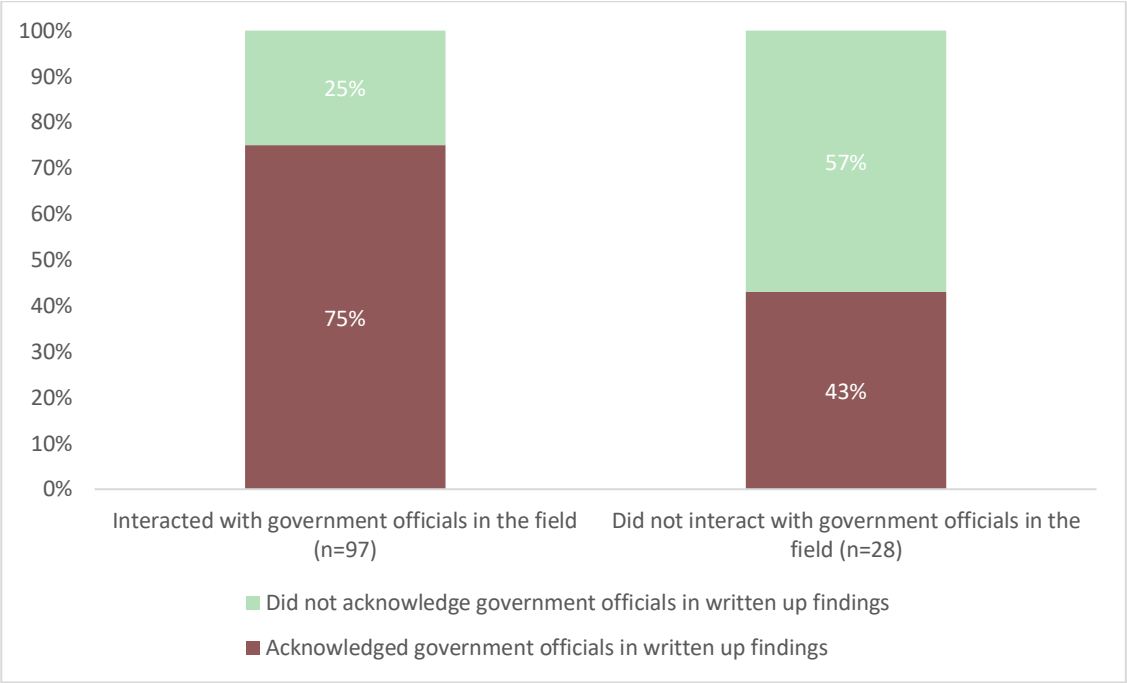


Figure 7-4 Acknowledgements of field interactions with government officials

The following statistically significant differences ($p<0.05$) were observed, based on the Bonferroni test for comparison of proportions:

"Interacted with government officials in the field" (75% acknowledged government officials) > "Did not interact with government officials in the field" (43% acknowledged government officials)

"Did not interact with government officials in the field" (57% did not acknowledged government officials) > "Interacted with government officials in the field" (25% did not acknowledged government officials).

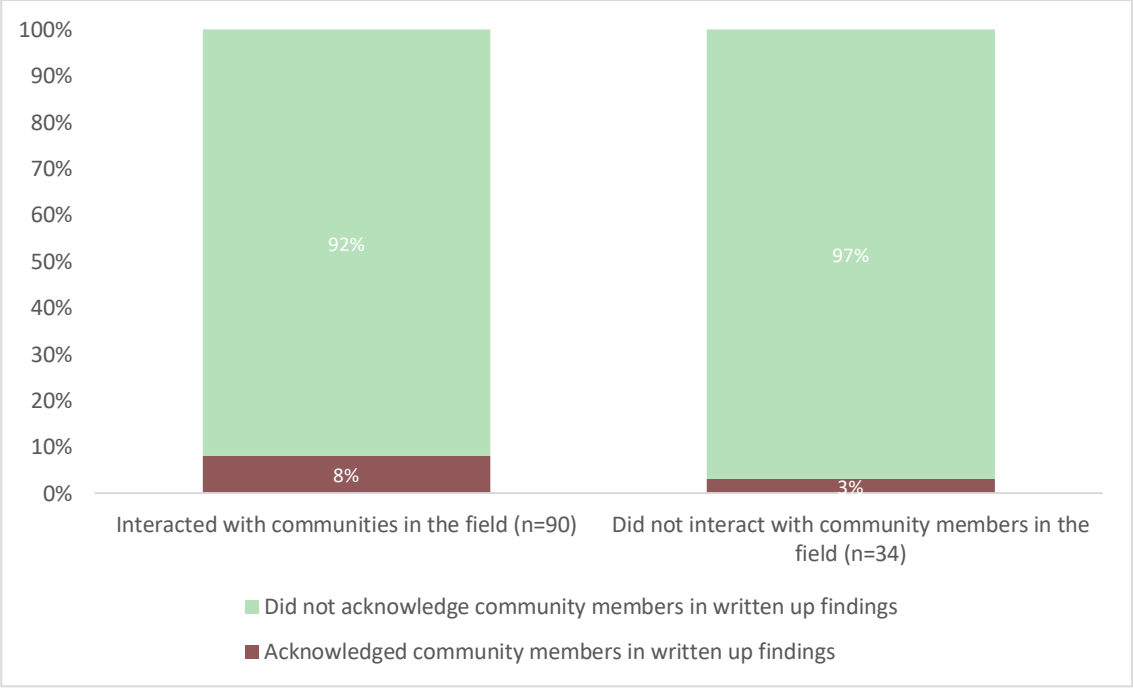


Figure 7-5 Acknowledgements of field interactions with community members

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

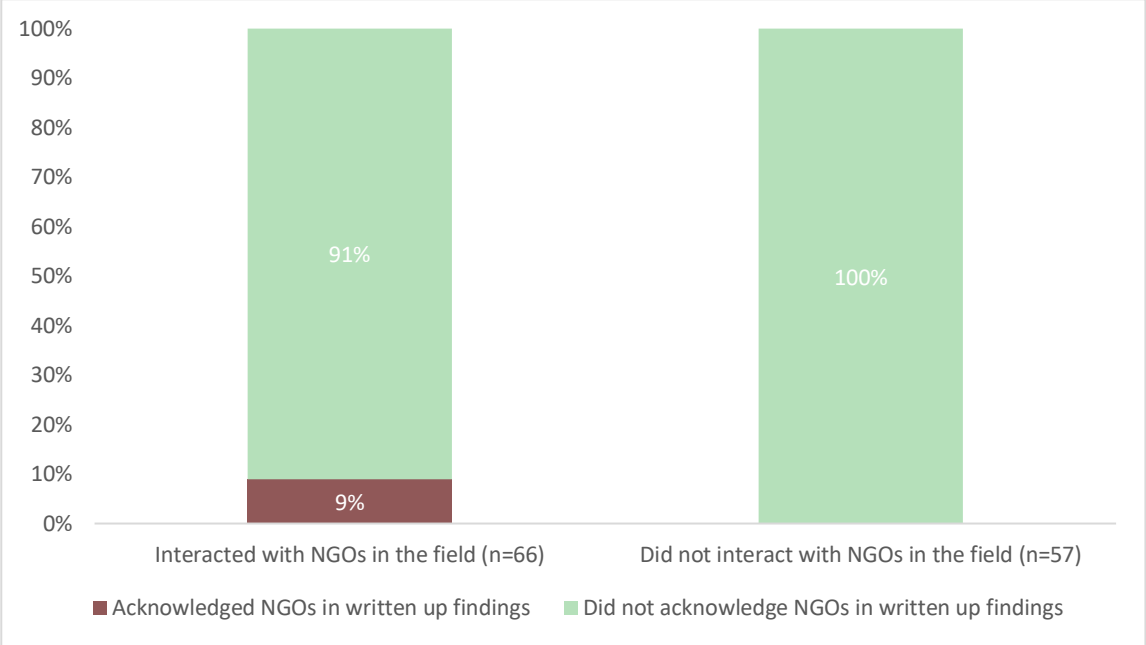


Figure 7-6 Acknowledgements of field interactions with NGOs

Note: No statistically significant differences were observed, according to a Bonferroni test for comparison of proportions.

Survey respondents who reported interactions with stakeholders in the field did not necessarily acknowledge these when they wrote up their findings. Field-based interactions with government officials were most reported as acknowledged (75%), with 43% of those who did *not* report interactions with government officials in the field indicating that they had acknowledged government officials in their written-up findings – likely referring to thanks for issuing of research permits before fieldwork began.

Only eight percent of those who reported interactions with community members in the field also reported that they acknowledged these in their written-up findings. This could seem to indicate that many of the interactions were casual, unintended encounters unlikely to be interpreted as productive interactions, but most of the open ended responses to this question referred to substantive, information-rich encounters, including working with community members as informants and employees:

> *"We went to see them to explain the project and request authorisation for sampling of livestock at the edge of the protected areas where we sampled wildlife."* **[Professional researcher in a South African university]**
>
> *"... regular interaction with community members to explain research, responding to medical needs of community members, employment of community members as camp staff, training of community scouts and guides."* **[Professional researcher from outside Botswana]**
>
> *"I always visited the nearby cattleposts and villages to even meet with their chiefs to discuss with them about my project. I interviewed the livestock owners about their perception on the persisting human-lion conflict around their area."* **[Student at a Botswana university]**

> *"Our team carried out regular environmental education campaigns at local primary schools throughout the Okavango. The team also engaged with communities where problem crocodiles were found and assisted these communities with the management of these animals."* **[Professional in the private sector]**

The lack of reporting of acknowledgments of these interactions could be an indication of the researchers' understanding of who and what should be acknowledged in their scholarly writing.

Only nine percent of those who reported interactions in the field with NGOs also reported that they had acknowledged the NGOs in their written-up findings. Many of the field interactions with NGOs described involved formal working relationships, which, it could be assumed, required acknowledgement:

> *"… hosted me and facilitated my research, which was developed in collaboration and coordination with them"* **[Student at a university, college, or research institution outside Africa]**
>
> *"We gave a workshop based on software that we gave them to support their research."* **[NGO researchers]**
>
> *"Staff of NGO participated in the fieldwork."* **[Professional researcher in a Non-Governmental Organisation]**
>
> *"For my first project, it was a local NGO that hosted me, so I had many, many interactions with them, for obvious reasons. I also met with other NGOs to understand the issues in my field site--I did this for both my 1st and 2nd project."* [**Student at a university, college, or research institution outside Africa]**

7.2.1.2 Relationship of survey acknowledgements to perception of use

Responses to the question about acknowledgements were compared with those to a question about whether the respondent believed their research had been used. Those acknowledged by the survey respondents were grouped into three broad categories, based on the core business of those acknowledged:

- The *Academic* group represents advisors and supervisory committees, other researchers, and research assistants, i.e. those whose core business is research.
- The *Contextual* group representing government officials, NGOs, tourism and other private sector organisations, and local communities, i.e. those whose core business is not research, but who could view research as complementary or supportive to their own work.
- The *Social* group, made up of family and friends, for whom core business can mostly be considered irrelevant. They were excluded in the analysis.

The two group categories used were converted into four mutually exclusive categories:

- At least one of each Contextual and Academic
- At least one Contextual but no Academic

- At least one Academic but no Contextual
- Neither.

The category, *At least one Academic but no Contextual*, had one response only and therefore was not included in the following Figure 7-7, which shows the results of the comparison.

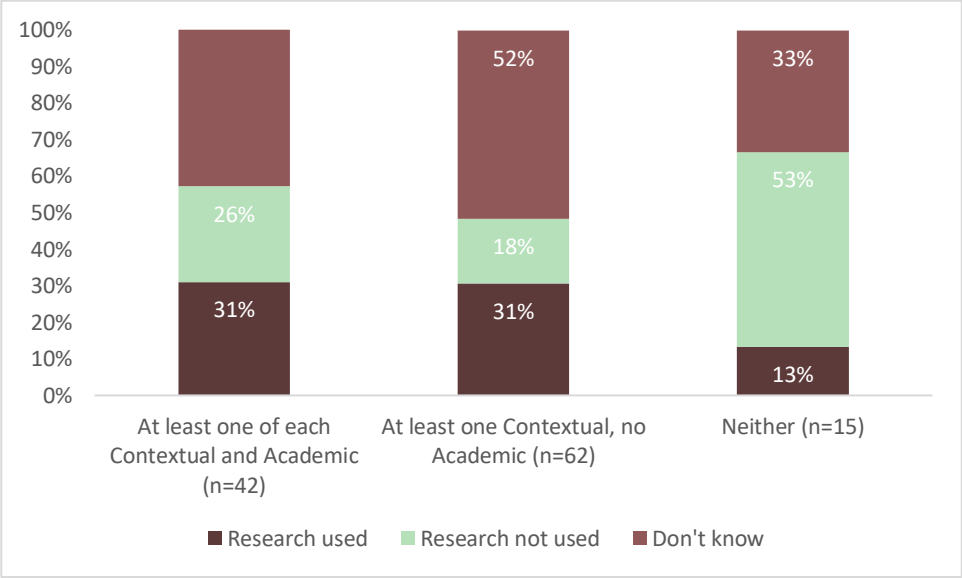


Figure 7-7 Perceptions of use by those who acknowledged others

Note: The following statistically significant difference ($p<0.05$) was observed, according to a Bonferroni test for comparison of proportions "Neither contextual nor academic entity acknowledged" (53% research not used) > "At least one contextual but no academic entity acknowledged" (18% research not used).

There were no examples of acknowledgement only of members of the Academic group – all respondents included in their acknowledgements entities whose core business was not research.

Forty-three percent of respondents who had acknowledged entities from both Contextual and Academic groups said that they did not know if their research had been put to use, 31% of these claimed that their research had been used, and 26% said that their research had not been used.

Fifty-two percent who had acknowledged Contextual, but not Academic, entities were unsure about the use of their research, 31% claimed that their research had been used, and 18% said that their research had not been used.

Thirty-three percent of those who had not acknowledged entities from either Contextual or Academic groups said that they did not know if their research had been put to use, 13% of these claimed their research had been used. The largest percentage (53%) of those who had *not* acknowledged members of either group said that their research had not been used.

These findings – especially where responses reported no acknowledgments in relation to a perception of no use – indicate a pattern of interactions that appear to be productive.

Broken down by specific entities, as shown in the following Table 7-1, there is a similar pattern of association of perception of research use with having acknowledged others. A notable exception is that of community members acknowledged, where more respondents indicated that their research had not been used.

Table 7-1 Acknowledgements by perception of use

	Entities Acknowledged	Research used	Research not used	Don't know
Contextual	Government officials (n=84)	**32%**	**23%**	**45%**
	Logistical support staff (n=49)	**45%**	**20%**	**35%**
	Tourism concession managers (n=29)	**34%**	**17%**	**48%**
	Guides (n=25)	**48%**	**12%**	**40%**
	Interpreters or translators (n=17)	**59%**	**12%**	**29%**
	Funders (n=14)	**43%**	**7%**	**50%**
	Community members (n=8)	**25%**	**38%**	**38%**
	NGOs (n=6)	**67%**	**33%**	**0%**
	Private sector (n=6)	**0%**	**17%**	**83%**
	Land stewards (n=5)	**20%**	**20%**	**60%**
	Informants (n=2)	**100%**	**0%**	**0%**
Academic	Students (n=29)	**48%**	**17%**	**34%**
	Other researchers (n=13)	**38%**	**31%**	**31%**
	Research institutions (n=6)	**50%**	**33%**	**17%**
	Supervisors (n=4)	**50%**	**50%**	**0%**
	Librarians (n=3)	**67%**	**33%**	**0%**
Social	Family (n=2)	**50%**	**50%**	**0%**
	Friends (n=2)	**50%**	**0%**	**50%**
	God (n=2)	**50%**	**50%**	**0%**

7.2.2 Acknowledgements by writers of theses and dissertations

To determine if there was a similar pattern of acknowledgement in dissertations and theses resulting from the research permits studied, the full text of 111 Masters and PhD theses produced under the research permits studied was obtained from those available in online sources. The acknowledgements sections of these documents were extracted and coded for the type of stakeholder acknowledged, and for what they were thanked. There were 1624 separate instances of acknowledgement in the 111 theses.

Categories used in coding the thesis content are shown in Table 7-2 and 7-3.

Table 7-2 Codes for who was acknowledged

Type of entity (who)	Coded as
Academic advisors	Supervisors
Camp staff	Logistical support staff
Drivers	Logistical support staff
Elephant handlers	Guides
Equipment suppliers	Other private sector
Field scouts	Guides
GIS suppliers	Other private sector
Graduate advisory committee	Supervisors
Mechanics	Other private sector
Pilots	Logistical support staff
Trackers	Guides
Training companies	Other private sector
Veterinarians	Logistical support staff
Volunteers	Research assistants

Table 7-3 Codes for what was acknowledged

Type of support (what)	Coded as
Academic guidance	Methodology, supervision, knowledge
Administrative assistance	In-kind support

Type of support (what)	Coded as
Equipment	In-kind support
Flights	Logistical support
Laboratory facilities	In-kind support
Laboratory work	Location access, In-kind support
Legitimacy	In-kind support
Mentoring	Mentorship
Mentorship	In-kind support
Permits	Location access
Photographs	Data collection
Plant identification	Data collection
Project participation	Supervision, fieldwork
Species identification	Data collection
Statistical analysis	Methodology
Text review, proofreading, editing	Editing

These categories were then used in the following analysis.

7.2.2.1 Types of entities acknowledged

Figure 7-8 shows what types of entity were most acknowledged in the theses.

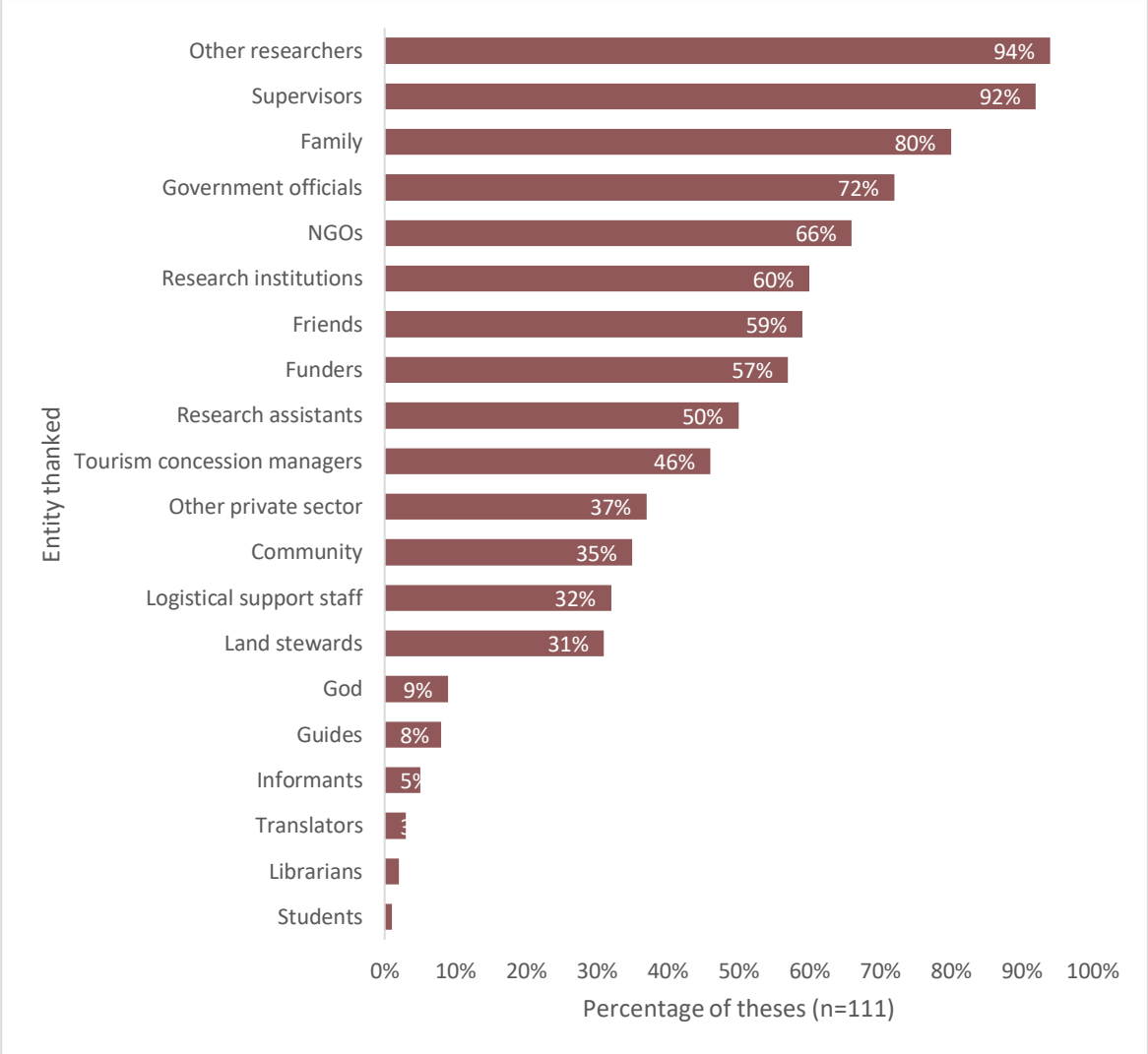


Figure 7-8 Entities acknowledged in theses and dissertations produced under research permits (n=111)

Comparison of the survey responses and analysis of the written acknowledgements shows several differences. Mostly other researchers (94%), supervisors (92%) and family (80%) are frequently acknowledged in the theses. This could reflect the nature of graduate study fieldwork, which can be attributed to relatively brief funding periods and a subordinate role in project teams. These do not always lend themselves to interactions in the field with other, non-academic, stakeholders. Supervisors and other researchers were usually thanked warmly and sincerely:

> *"I am thankful for [other researcher] for the enthusiasm and excellence that he bestowed upon me during our chats in the office as well as in the field and for his financial support that made this research possible."* **[Student at South African University]**
>
> *"I would like to thank [name of supervisor] for advising me to pursue a doctorate and for accepting me into the [name of research institution] family and [name of other researcher] taking me on board and allowing me take full advantage of the research*

facilities and his invaluable and extensive knowledge of the area." **[Student from a university outside Africa]**

"This study would not have been possible without the generous guidance and support of my fellow researchers working in the same parts of Botswana, who everyday resist complacency in their care for Kalahari landscapes and their communities." **[Student at South African university]**

"[Other researcher], is thanked for allowing me to visit with him at [name of university] for most of 2006. This was an enriching experience and interacting with his students and colleagues assisted greatly in focussing my effort in processing my extensive data set." **[Student at South African university]**

Family members acknowledged included the largely emotional support provided by parents, siblings, spouses, children and pets:

"… my family, friends and [name withheld] for all your supportive letters and phone calls during my three months in Kalahari. You always cheered me up when it was hard and felt lonely. It meant a lot to me, and it would not have been such an amazing experience without all your support." **[Student at university outside Africa]**

"… my family, without whom this dissertation would certainly not have come about … my wife … for standing by me throughout graduate school and for being a support, encouragement, and source of joy when things were rough. She also came into the field to help me collect data in Africa, maintaining a good attitude even when it meant stopping for yet another herd of impala… my son … for keeping a smile on my face in the final months of analysis and writing. My mother and father have supported my love of wildlife from a young age, taking me to zoos, enabling me to go on my first trip to Africa, and equipping me with the skills that would allow me to be successful as a wildlife ecologist. They also continue to edit and review my articles and grant applications. I cannot thank them enough for their investment in me." **[Student at university outside Africa]**

"… my family … for financial support, emotional support, continued encouragement, willingness to listen and contribute ideas, helping me drive to [name of camp] with my broken leg, putting up with me at home during the write-up and contributing ideas throughout the duration of the study." **[Student at university outside Africa]**

7.2.2.2 Types of support acknowledged

In terms of aspects of the work eliciting gratitude, the following Figure 7-9 considers 19 types of assistance provided to researchers during their fieldwork period.

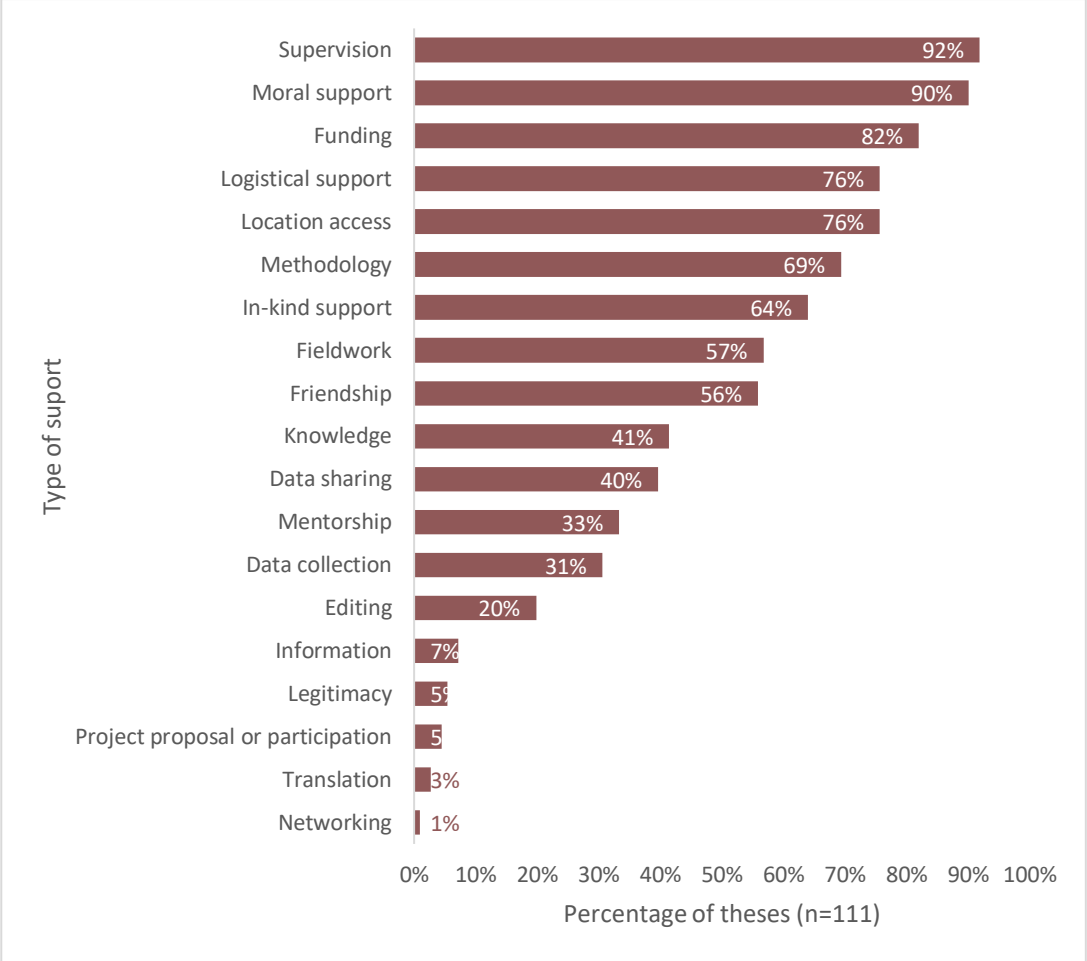


Figure 7-9 Types of support acknowledged

Supervision (92%) and moral support (90%) were most mentioned by the thesis writers, with funding coming third (82%). It appears that the interactions related to all of these were judged highly important in producing a thesis. Logistical support, with its face-to-face contact and opportunity for direct interactions and location access needed for fieldwork, were fourth mentioned (76%) by the thesis writers. This might be expected in northern Botswana, with its challenging dust tracks and the remote location of wildlife. This type of assistance was often combined with in-kind or financial support:

> *"I would like to thank the elephant handlers … for assisting me recover ingestible devices and for excellent company in the field."* **[Student at South African University]**
>
> *"I am also in debt to the several truck drivers and fellow travellers on backward for their assistance in breakdowns and in traversing difficult terrain driving to and from the … study area…."* **[Student at South African university]**
>
> *"… for the funding, subsistence and support provided for the duration of this project, without which this project would not have been possible"* **[Student at South African university]**

> *"*[Names withheld] *... graciously allowed me to collect data in their concession and provided food and lodging for us every month while we were trapping there. At [name of safari camp], I am grateful ... the entire management and staff for putting up with "guests" who insisted on going out and "catching rats" every day and never seemed to leave!"* **[Student at university outside Africa]**

Emotional support – moral support (90%) and friendship (56%) – were high on the list of assistance mentioned by thesis writers, more mentioned than knowledge, data collection, and more practical assistance. It could be argued that the latter also contributed to emotional support through openness and willingness that others demonstrated to assist and to share. Accounts that illustrate this indicate many direct interactions:

> *"... who began the project, collected the first year's worth of data and gave advice and encouragement"* **[Student at South African university]**
>
> *"I must also thank [name withheld] from [name withheld] Safaris for constructing my camera traps boxes free of charge, and always offering a helping hand with all aspects of the research."* **[Student at university outside Africa]**
>
> *"... to my great friends in the lab ... for the moral support and technical advice"* **[Student at university outside Africa]**
>
> *"... deserves a special thank you for all these evenings of trying to understand what it is that I am talking about when you asked me about work! You are a star and I am very happy to have a friend like you!"* **[Student at university outside Africa]**
>
> *"I would have been literally and metaphorically lost without the insight, organizational skills, sense of direction, energy and charisma of my lead assistant ... in many ways you really led this research project and the title 'assistant' does not do you justice."* **[Student at university outside Africa]**
>
> *"...Without you I would probably still be stuck in the bush with my broken-down Land Rover. On a serious note, you are the backbone of this thesis and my appreciation for all the emotional, logistical and intellectual support are difficult to put into words."* **[Student at university outside Africa]**

Mantai and Dowling (2015) categorise support acknowledged in Australian PhD dissertations as 1) *Academic (*editorial and linguistic and academic and conceptual*)*, 2) *Instrumental* (technical, financial and administrative) and 3) *Social* (emotional and moral). These categories were reflected in the acknowledgements excerpted from this study's collection of theses, with the substitution of *Contextual* for *Instrumental*. Grouped by the three broad categories based on the core business of those acknowledged, there is a similar pattern of themes among the services. Table 7-4 provides evidence for this through the pairing of the two: who and what were acknowledged.

Table 7-4 Comparison of support acknowledged by entity type (10% or greater)

Academic	Contextual	Social
Supervisors-Supervision (91%)	Government officials-Location access (68%)	Family-Moral support (80%)
Other researchers-Methodology (57%)	Funders-Funding (57%)	Friends-Moral support (38%)
Research assistants-Fieldwork (37%)	NGOs-Funding (37%)	Friends-Friendship (30%)
Research institutions-Funding (37%)	Land stewards-Location access (31%)	Friends-Logistical Support (10%)
Other researchers-Friendship (30%)	Logistical support staff-Logistical support (30%)	
Other researchers-Moral support (28%)	Tourism concession managers-In-kind support (27%)	
Other researchers-Knowledge (24%)	NGOs-Logistical support (24%)	
Other researchers-Logistical support (24%)	Other private sector-In-kind support (23%)	
Other researchers-Data sharing (23%)	Tourism concession managers-Location access (20%)	
Other researchers-Mentorship (20%)	Tourism concession managers-Logistical support (17%)	
Research institutions-Methodology (20%)	Other private sector-Logistical support (15%)	
Other researchers-Fieldwork (19%)	Community members-Friendship (14%)	
Supervisors-Mentorship (15%)	NGOs-In-kind support (14%)	
Other Researchers-In-kind support (14%)	Government officials-Logistical support (14%)	
Other researchers-Editing (13%)	Community members-Location access (13%)	
Supervisors-Methodology (12%)	Community members-In-kind support (13%)	
Other researchers-Supervision (11%)	Other private sector-Funding (12%)	
Super**visors-Moral support (11%)**	Other private sector-Location access (10%)	
Other **researchers-Data collection (10%)**		
Research assistants-Data collection (10%)		

Within the Academic group, supervision, methodology and fieldwork were most mentioned, with funding and friendship following. Supervision included a range of support from individual advisors to graduate committees, and from selection of research topics to practical guidance in the field and methodological direction.

> *"... for taking me on as one of your PhD students and allowing me to develop my dissertation research from the ground up"* **[Student from university outside Africa]**
>
> *"... whose advice has always been, if not the most straightforward to interpret and apply, but definitely most enlightening as time went by"* **[Student from university outside Africa]**
>
> *"... provided me with the insight on how to think about ecology particularly in the context of disturbances. ... introduced me to the idea regarding how the utilization and distribution of natural resources influences livelihood decisions. ... showed me the importance and long use of human-induced fires on the landscape. ... contributed to my methodological and statistical analysis of the time-series data that I utilized in this research. ... was the voice of reason regarding my interpretation of the Okavango landscape"* **[Student from university outside Africa]**
>
> *"... who both gave me the freedom to explore on my own, while at the same time diligently guiding and scrutinizing my work and making comments that inspired critical thinking"* **[Student from university outside Africa]**

For the purpose of this thesis, the *Contextual* group is of most interest, because it represents potential users outside the normal sphere of academic influence, but within the northern Botswana wildlife research community of practice. It is interesting to consider the types of interaction implied by these acknowledgements.

Location access provided by government officials (68%), and funding by a cross section of grant-makers and donors (57%), represent services that require a measure of formal, documented interaction, which is often indirect. This formality indicates an investment of resources that might be expected to result in recognition of the research produced. When combined with the interactions involved in direct joint research effort, as it was sometimes the case with DWNP and NGOs, one might expect even more uptake and use of the research.

> *"I was employed by [name of NGO] during the monitoring of translocated cheetahs, predator density estimates and cheetah prey identification.... its funders and its board of directors for allowing me to use the data towards my PhD thesis and for their financial and administrative support. I thank the Botswana Department of Wildlife and National Parks for permission to conduct the research. I specifically thank [names withheld] and the other members of the DWNP who assisted with data collection and with the translocation of cheetahs."* **[Student at South African university]**
>
> *"I would like to take this opportunity to thank the Department of Wildlife and National Parks of Botswana for granting me permission to conduct this research and for the opportunity to work in the Makgadikgadi. Logistical support provided by the Department*

> *of Wildlife was essential in capturing and collaring zebra and wildebeest for this project. … The Makgadikgadi is a vast, untouched wilderness where the constraints of the environment are liable to be the end of the researchers as well as their study animal. The support of local safari camps [names withheld] and all of the staff who worked there was more than welcomed and not a little essential."* **[Student at university outside Africa]**
>
> *"All the staff at the Department of Wildlife and National Parks for the assistance with permits, access to records, and for assistance at the gates of the Central Kalahari Game Reserve, especially the park manager [name withheld]."* **[Student at university outside Africa]**
>
> *"To [Name of NGO withheld] for your assistance with some of the survey designs and help in securing funding for the project."* **[Student at South African university]**
>
> *"… to [name of NGO withheld] who welcomed me into the team … sorted out all the logistics for me to study … in Botswana, obtained funding for various aspects of my research, shared their data with me, and let me stay in their beautiful research camp".* **[Student at university outside Africa]**

Tourism concession managers and other private sector actors were frequently also acknowledged for location access, in-kind support, and logistical support (from 15% to 23%). Most of this assistance involved direct interactions between researchers and those who were assisting.

> *"To [name of organisation withheld] for allowing me the opportunity to conduct this study within the boundaries of the Northern Tuli Game Reserve, assistance during the total aerial counts, and financial contribution to the project."* **[Student at South African university]**
>
> *"… [name of organisation withheld] who spent many a cold night waiting patiently for a chance to dart a brown hyena".* **[Student at university outside Africa]**
>
> *"The staff of [name of safari camps withheld] provided me with support, entertainment and a particularly clear window onto local perceptions of livestock predation. … To all those people that accommodated my cash flow problems (I think this covers most merchants in Maun) thanks for your tolerance and infectious faith in the banking system. Special thanks to [names withheld] for helping me limp my truck through 5 years and 250,000 km of mechanical hell without breaking the bank (more than it already was).* **[Student at university outside Africa]**

Local community members were also thanked for friendship (14%), access (13%), and in-kind support (13%), which sometimes included data collection:

> *"I am extremely grateful also to the farmers of [names of communities withheld] who diligently got in contact after each crop raid and gave up their time to allow me to assess their field."* **[Student at university outside Africa]**
>
> *"… the [name of community trust withheld] and the village of [name withheld] for the possibility to conduct research in the area. I am grateful for all advice and help in the field, through which I now know how to handle wet season driving and stubborn elephants".* **[Student at university outside Africa]**
>
> *"A number of residents in [name of town] provided information about opportunistic sightings of mongooses, directed me to mongooses killed on the roads or by dogs (which*

> *we subsequently necropsied), and allowed me to monitor mongooses when they were on their private property. … In particular, I thank [name withheld] for providing detailed data on mongoose sightings on a weekly basis from the [name of park withheld], and [name withheld] who provided sightings and assistance with finding a mongoose troop."* **Student at university outside Africa]**

> *"The selfless participation and cooperation of the residents of [names of communities withheld] is what has made this study a reality. My heartfelt gratitude goes out to them all for educating me - that the most important education is not only obtained from the classroom. I was particularly humbled by how most of my study informants would still tolerate, with a smile, my interruption of their daily activities just to ask questions which they knew very well would not provide immediate solutions, if any, to their livelihood issues."* **[Student at university outside Africa]**

As well as being acknowledged for provision of research permits, government officials were thanked for logistical support (14%) and data sharing (less than 10%). This assistance was usually provided in the protected areas managed by the DWNP, but sometimes took the form of services performed from government offices:

> *"I am grateful to [government staff names withheld] for the valuable assistance I got from their staff during data collection. [Names withheld] always availed logistic support in the form of equipment, transport and accommodation. I am indebted to [names withheld] for providing me with information when I needed it [outside the country]. [Name withheld] from the Botswana Meteorological Services provided climatic data for the study area."* **[Student at university outside Africa]**

> *"I would also like to thank [name of government official] for the help with the species identification during the fieldwork."* [**Student at university outside Africa**]

> *"[Name of government official withheld] helped with ideas on vegetation sampling protocols, while [names withheld] were always available to share their thoughts and experiences on work, and resources that the Department of Wildlife and National Parks could provide."* [**Student at university outside Africa**]

7.2.3 Correspondence of written acknowledgements and survey responses

To help to answer the question of whether written acknowledgements can be used as a proxy for productive interactions that might lead to uptake, their content can be compared with other evidence of assistance acknowledged. To this point in the chapter, written thesis acknowledgements and responses to the survey questions about acknowledgements have been analysed separately. Comparing these for only those student principal investigators who responded to the survey, and for whom the text of a thesis was available, provides some indication of the reliability of thesis acknowledgements as indicators of important interactions.

Both a response to the research permit survey and written acknowledgments from a thesis were available for 38 student principal investigators. A dataset that combined these was created,

organised by the entities (e.g. government officials, funders, etc.) that were acknowledged in the two sources. For each entity, then, it was possible to note whether it had been acknowledged in the survey response only (yes-no), in the thesis only (yes-no), in neither (no-no), or in both (yes-yes). A percentage was established to indicate a negative correspondence – when the correspondence value is composed of more 'no-no' combinations than 'yes-yes' combinations – or a positive correspondence – when there were more 'yes-yes' combinations than 'no-no' combinations.

Table 7-5 shows the correspondence between the two sources, with the columns for *Positive correspondence* and *Negative correspondence* indicating the degree to which the two sources acknowledged the same entities. The correspondence values were created by adding the values for cases in which entities were acknowledged in both sources (yes-yes), and for cases in which entities were not acknowledged (no-no) in both sources. For each cross-tabulation, the values of the four cells add to 100% (or about 100%, given rounding errors).

Table 7-5 Comparison of sources of acknowledgement by entity acknowledged

		Acknowledgement in thesis		Negative correspondence	Positive correspondence
		Yes	No		
COMMUNITY MEMBERS (n=38)					
Acknowledged according to survey	Yes	3%	5%	71% (n-n>y-y)	
	No	24%	68%		
GOVERNMENT OFFICIALS (n=38)					
Acknowledged according to survey	Yes	55%	11%		66% (y-y>n-n)
	No	24%	11%		
FUNDERS (n=38)					
Acknowledged according to survey	Yes	11%	0%	48% (n-n>y-y)	
	No	53%	37%		
INFORMANTS (n=38)					
Acknowledged according to survey	Yes	0%	0%	87% (n-n>y-y)	
	No	13%	87%		
GUIDES (n=38)					
Acknowledged according to survey	Yes	8%	21%	74% (n-n>y-y)	
	No	5%	66%		
INTERPRETERS OR TRANSLATORS (n=38)					
Acknowledged according to survey	Yes	3%	16%	85% (n-n>y-y)	
	No	0%	82%		
LAND STEWARDS (n=38)					
Acknowledged according to survey	Yes	0%	3%	76% (n-n>y-y)	
	No	21%	76%		
LOGISTICAL SUPPORT STAFF (n=38)					
Acknowledged according to survey	Yes	16%	32%	50% (n-n>y-y)	
	No	18%	34%		
NGOs (n=38)					
Acknowledged according to survey	Yes	3%	3%	48% (n-n>y-y)	
	No	50%	45%		
OTHER PRIVATE SECTOR (n=38)					
Acknowledged according to survey	Yes	0%	3%	61% (n-n>y-y)	
	No	37%	61%		
TOURISM CONCESSION MANAGERS (n=38)					

		Acknowledgement in thesis		Negative correspondence	Positive correspondence
		Yes	No		
Acknowledged according to survey	Yes	21%	3%	82% (n-n>y-y)	
	No	16%	61%		
OTHER RESEARCHERS (n=38)					
Acknowledged according to survey	Yes	5%	0%		8% (y-y>n-n)
	No	92%	3%		
RESEARCH INSTITUTIONS (n=38)					
Acknowledged according to survey	Yes	3%	0%	37% (n-n>y-y)	
	No	63%	34%		
STUDENTS (n=38)					
Acknowledged according to survey	Yes	0%	29%	71% (n-n>y-y)	
	No	0%	71%		
SUPERVISORS (n=38)					
Acknowledged according to survey	Yes	5%	0%		5% (y-y>n-n)
	No	95%	0%		

Overall, this analysis shows that when an entity was thanked in written acknowledgements, it was not, for the most part, also mentioned in the corresponding survey response. For example, in only 3% of cases did student principal investigators acknowledge community members in both their survey response and written thesis acknowledgements. The exception to this pattern was acknowledgement of government officials, with a positive correspondence of 66%. Based on this analysis, 55% of research-government interactions would have been identified by relying on written acknowledgements in theses, based on the assumption that the survey response represented the true state of affairs.

These results indicate that, while it is worthwhile to look at written acknowledgements for indications of productive interactions, they should be used cautiously as a proxy on their own.

7.2.4 Can acknowledgements point the way to productive interactions?

Results of the analysis of both survey responses and written acknowledgements from theses and dissertations appear to indicate that although acknowledgments are brief, they form indicative records of interactions between researchers and potential users of the research.

Defining interactions as productive, as in Chapter 5, if they lead to further interactions, show local relevance, increase awareness, build trust, and increase understanding, it is possible to argue that most of the interactions reflected in acknowledgments were productive.

While examination of written thesis acknowledgements did not readily reveal interactions that led to other interactions, thesis writers frequently made references to people or locations that either led to, or enriched their investigations:

> *"She is the one who first suggested to me that the art of tracking might be a way into my interests in the Kalahari Desert and environmental knowledge politics. She introduced me*

> *to [name of researcher], who introduced me to [other researchers], who introduced me to [name of local tracker]. I have not stopped tracking since."* **[Student at university outside Africa]**
>
> *"... devoted much of his time to helping me develop my research proposal and forged many contacts ... that led to collaborations and work in [name of protected area], which would not have been possible without him."* **[Student at university outside Africa]**

Indicators of relevance of research to local conditions can be found in the gratitude expressed for Botswana-based support provided, through issuing of research permits by the Botswana government, and through funding and in-kind support from organisations and people in Botswana.

> *"[Name of safari operator] and their Environmental Department in particular their assistance during the project, for access to their concessions and lodges where the research was conducted, use of their vehicles and equipment, and flexibility with regards to time granted for my studies."* **[Student at university in South Africa]**

Interactions with a cross-section of stakeholders led to more awareness of the research in the broader community.

> *"The staff from the two Safari lodges ... were always friendly and welcome, allowing me to use their facilities, fix the vehicle, use their airstrips, and even their airplanes, and give talks to their guests about the research."* **[Student at university outside Africa]**

Documented trust between researchers and others was often a product of working together, as was development of mutual understanding.

> *"spent a lot of time during the beginning of the fieldwork teaching me the road networks, concession rules and helping me identify many of the trees and grasses. They also showed a continuous interest in the study and shared many thoughts and ideas with me during the project for which I am also extremely grateful."* **[Student at university in South Africa]**
>
> *"provided invaluable field assistance, friendship and much needed help in navigating the joys and intricacies of Batswana society"* **[Student at university outside Africa]**

Reading the acknowledgements of thesis writers also reveals examples of the elements that make up a community of practice: mutual engagement, joint enterprise and shared repertoire.

To determine whether it is possible to gauge the quality of interactions documented in acknowledgments, text from the theses was examined closely to discover whether joint enterprise had been involved. Some theses did not specifically mention interactions with non-academic entities, but the acknowledgements in the following nine speak to the effect that working together with them had on their research experience:

> *"Logistical support provided by the Department of Wildlife was essential in capturing and collaring Zebra and wildebeest for this project. A big thanks goes to the chopper flying of [name of pilot] and the trusty aim and shot of [name of veterinarian] while darting....*

Working alongside close friends through long, hot, dusty hours sometimes even made grass sampling a pleasure". **[Student at university outside Africa]**

"I would like to thank all the people I interviewed for their time, honesty and for letting me appreciate what being on the receiving end of lions was really like. Particular thanks must go to [name of community member] who gave me a particularly clear insight into cattlepost life both as it is and as it was, and who was never short of advice regardless of how urgently I needed to get going." **[Student at university outside Africa]**

"I am grateful to [names of government officials] for the valuable assistance I got from their staff during data collection…. always availed logistic support in the form of equipment, transport and accommodation." **[Student at university outside Africa]**

"Last but not least I would like to thank all members of the [name of research group] for their social support. Some have been with me in the field under challenging situation where some of the big five roam freely. [Name of field volunteer] is remembered for making a joke and laughing to attract the attention of an elephant bull while I tiptoed under small shrubs to pick up trap." **[Student at South African university]**

"… to [name of individual donor] for his generous decision to support me during my writing up period and for the numerous hours he gave to dart reluctant buffalo from a vehicle". [73]

"Thank you to all my field assistants … for your hard work and valuable assistance. A big thank you as well to [names of community members] for keeping me and the research camp safe from elephants (and other dangers!!), over the past three years." **[Student at university outside Africa]**

"To [name of land steward] for allowing me the opportunity to conduct this study within the boundaries … assistance during the total aerial count. … [government officials], all the pilots, navigators and counters for assistance during the elephant counts. A special word of thanks to [pilots] for their superb flying and always bringing us home safely…. To the rangers for teaching me all I know about the [region] and assisting me with finding and tracking elephants on the reserve." **[Student at South African university]**

"… for giving me the opportunity to be part of the team at the [name of NGO], for their advice, help and friendship during my four years in the bush. …I would like to thank the several vets for freezing out there at night while waiting for animals to dart and for their immense patience and commitment." **[Student at university outside Africa]**

The remaining three theses referred to the value of interactions with other researchers and research institutions, indicating that an important benefit of working together is the learning that takes place:

" … and to [name of researcher] his help and guidance in planning and supporting logistically challenging field campaigns in the central Kalahari and providing valuable insights through discussion. I would also like to recognize [names of researchers] and field assistants for their help, guidance and logistical support during the three field campaigns in the central Kalahari." **[Student at university outside Africa]**

"I would also like to thank [name withheld], who has provided much input into my research even though he did not serve as a member of my committee. …Thank you also to my enumerator team [names withheld] for their many hours of hard work in the field." **[Student at university outside Africa]**

> *"The success of the field research in rural African countries largely depended on the generous collaborations with the Ministry of Agriculture of Botswana, the office of the Permanent Secretary for the Western Province of Zambia, the Zambian Department of Meteorology and the Harry Oppenheimer Okavango Research Centre of the University of Botswana."* **[Student at university outside Africa]**

It seems clear that conservation field research offers many more opportunities for interactions between researchers and non-academics than might be the case with other scientific disciplines that work mainly in controlled settings such as laboratories, or with computer modelling. These opportunities can be charged with additional memorability and emotional impact because of the dependence of researchers on others in a frequently inhospitable, and sometimes threatening, physical and cultural environment. Dependency on local expertise leads to the need to recognise its contribution to the work, and the need to work together in a form of mutual engagement that has a tangible goal. The stakeholders engaged in this process of what Diver and Higgins (2014) have called *dynamic reciprocity* receive both material and intangible benefits through what often becomes joint enterprise. Then the shared experience frequently reported in acknowledgements produces shared repertoire in the form of both technical terminology and the narratives that signal belonging.

7.3 Capacity-building as uptake of research from Botswana research permit work

One form of uptake and use of research is development of the knowledge and skills of new researchers. The need to increase research expertise to address local capacity for biodiversity planning and management through education and training has been emphasised for Botswana (Botswana Ministry of Wildlife Environment and Tourism, 2007; UNESCO, 2013), and for sub-Saharan Africa as a whole (O'Connell et al., 2017). Given the perception that graduate students studying conservation science topics in Africa are often not citizens of the countries where they are carrying out fieldwork (Reboredo Segovia, Romano, & Armsworth, 2020), the degree – and ultimate location – of capacity built from research activities needs to be interrogated.

Development of research capacity in conservation science is built into an academic system that mentors, and directs the work of, students in an intensive process of direct and indirect interactions. Capacity-building through this system creates a research work force that contributes to the potential for broader uptake of scientific findings. Studies have linked both academic and social uptake of research to researchers' time spent in mentoring students (V. M. Nguyen, Young, Brownscombe, & Cooke, 2019). My analysis of thesis acknowledgments in Section 7.2.2.1 has indicated that

interactions between students and their supervisors and advisors, as well as with other students, can be considered productive in influencing the uptake and use of the research produced.

A research thesis or dissertation is codified evidence of a student's research and – by extension – of capacity built, and it can function as an indirect productive interaction through going on to build knowledge by influencing other work. To determine if it was possible to see the uptake of Botswana research through capacity building, theses and dissertations created under the MENT research permits studied were identified to determine ***direct capacity-building*** outcomes: those where capacity building flows directly from the production of a thesis in a project. The deliverance of thesis, as a direct project output, indicates that capacity building occurred for people in the project.

Then, a set of documents that cited the original set of research permit outputs was assembled to seek evidence of ***indirect capacity-building*** outcomes from the Botswana studies, where the outputs of a project, whether theses or other types of outputs, contributed to the capacity-building of others, since a project output was consulted by those others to produce a thesis or dissertation. Thus the project also indirectly contributed to another thesis for someone not in the project. Analysis of citations of original outputs, then, can capture evidence of indirect capacity building.

For ease of reference, only the term *thesis* is used moving forward in the text to describe Bachelor's, Master's, and doctoral works examined in this study. Bachelor's degree outputs included final year research papers, sometimes referred to as capstone studies.

7.3.1 Direct capacity building outputs and outcomes

What kinds of research outputs resulted from the studied permits? It was possible to identify outputs from 200 of 256 MENT permits issued over the study period. 1138 unique outputs from these permits were identified over a four-year period (2015-2019) by searching by author and date range in library catalogues, online repositories, and bibliographic databases.

For 77% of the 200 permits, there was at least one journal article associated with the permit, and for 39%, at least one non-academic web publication. Figure 7-10 shows the breakdown of all the document types represented in the outputs.

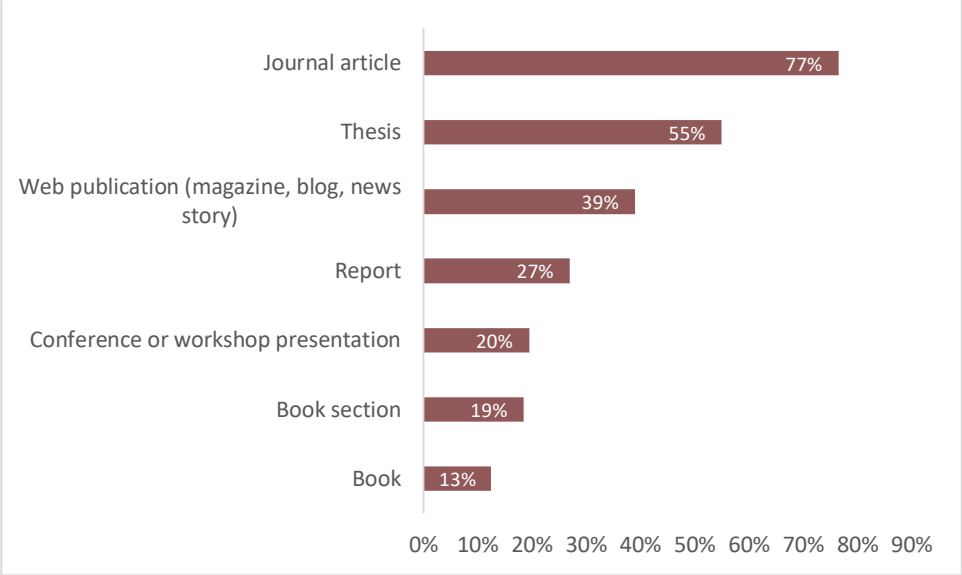


Figure 7-10 Output document types associated with research permits (n=200)

110 of the permits (55%) had produced at least one student thesis or dissertation, directly building capacity of the student writer. The following Figure 7-11 shows a breakdown of the number of theses produced under individual permits.

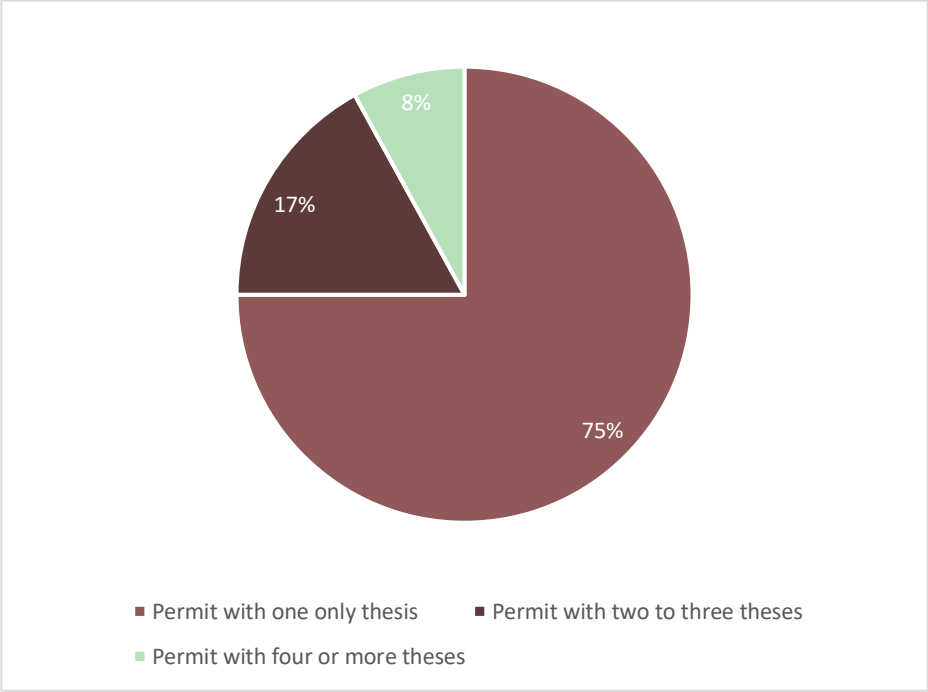


Figure 7-11 Theses produced under research permits (n=110)

There were 159 unique theses associated with the research from 110 permits because some permits produced more than one thesis. All but one of the theses were based on work carried out in Botswana.

Of the 159 theses, four were associated with production of a Bachelor's degree, 70 were associated with a Master's degree, and 85 were associated with at a PhD degree. The following Figure 7-12 illustrates the breakdown in terms of percentages.

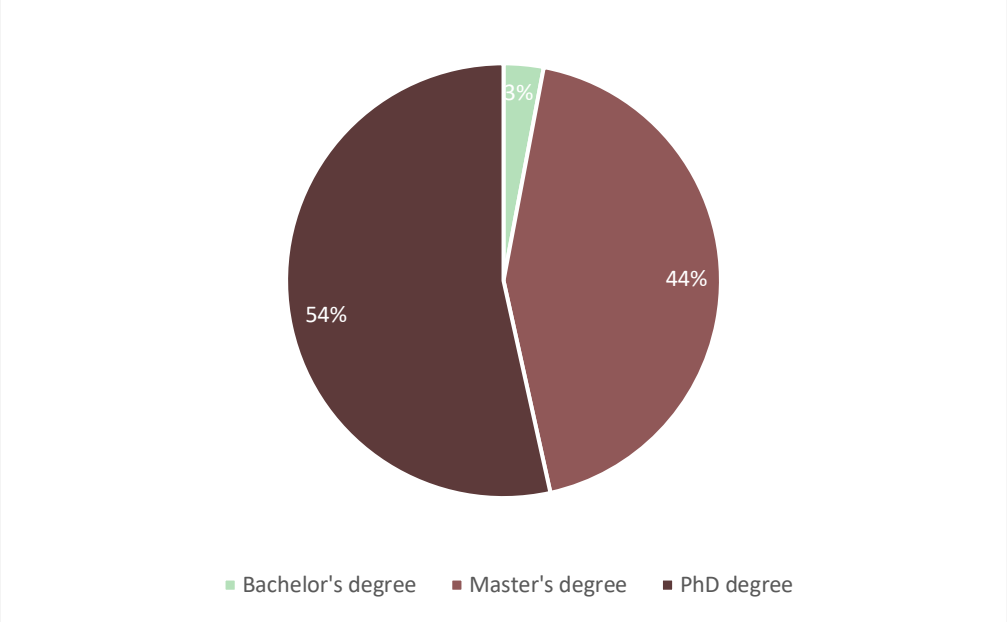


Figure 7-12 Qualification level of 159 degrees produced under 110 research permits

Institutions granting the degrees for the theses produced represented 14 countries. Figure 7-13 indicates the percentage of degrees from these countries.

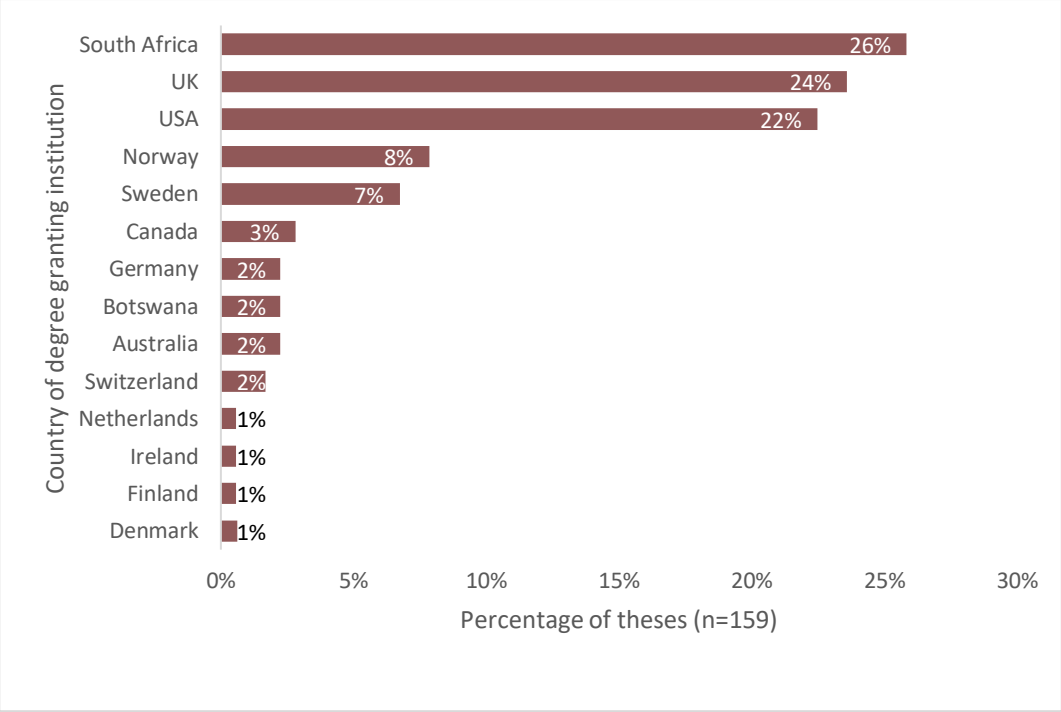


Figure 7-13 Countries of degree-granting institutions associated with research permit outputs

The map in Figure 7-14 illustrates the distribution of research permit output theses by country of degree-granting body.

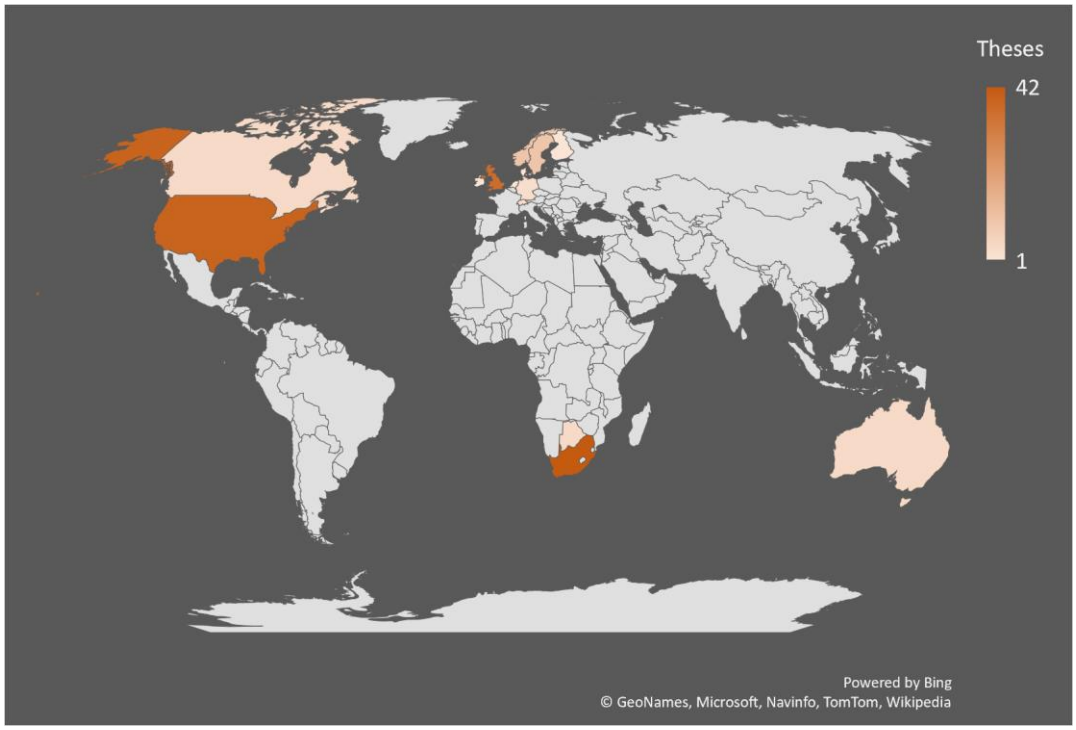


Figure 7-14 Map indicating number of research permit output theses by country of degree-granting body

South African institutions produced most of the theses associated with research permits (46 theses or 26%), followed by the United Kingdom (42 theses or 24%), and the USA (40 theses or 22%). Theses from institutions in other countries numbered 14 or fewer each.

Table 7-6 Degrees associated with research permits by country

Country of Granting Body	Bachelor's	Master's	PhD	Total
South Africa		28	14	42
USA		9	30	39
UK	1	11	24	36
Norway		6	4	10
Sweden	3	6	1	10
Australia			4	4
Botswana		4		4
Canada		4		4
Germany		1	2	3

Country of Granting Body	Bachelor's	Master's	PhD	Total
Switzerland			**3**	**3**
Denmark			**1**	**1**
Finland			**1**	**1**
Ireland			**1**	**1**
Netherlands		**1**		**1**
TOTALS	**4**	**70**	**85**	**159**

United States and UK institutions issued the most PhD degrees associated with the research permits; South Africa the most overall, and the most Master's level degrees.

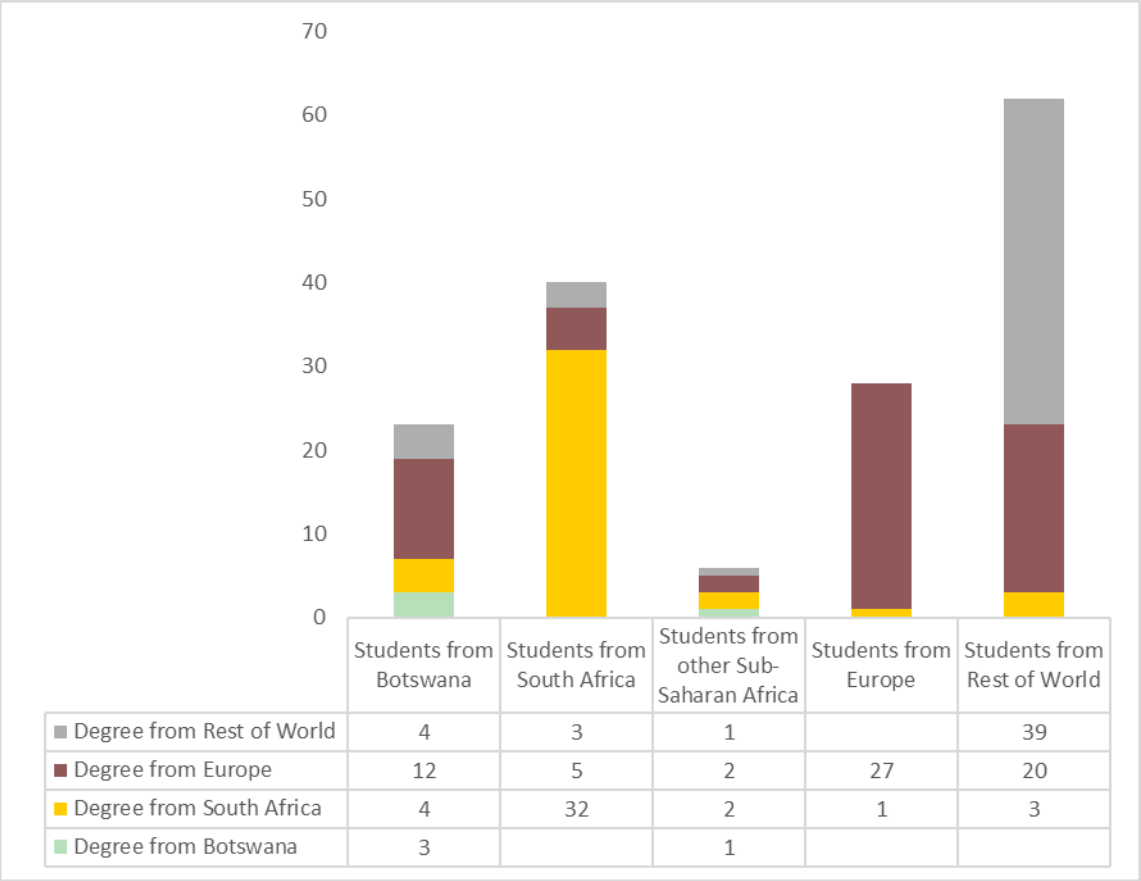
Do the theses associated with the studied research permits indicate that research capacity was being developed in the region studied? The country of origin of student thesis writers was established through contacting the writers or by determining their origin through online sources. The following Table 7-7 breaks the theses down by country of origin of the student.

Table 7-7 Research permit thesis writers by country of origin

Student's Country of Origin	Number of Theses
South Africa	40
USA	36
UK	23
Botswana	23
Sweden	10
Canada	5
Australia	5
Germany	4
Switzerland	3
Namibia	2
Kenya	2
Zambia	2
Ireland	1
Denmark	1
Norway	1
Netherlands	1

South African students produced the most theses, followed by students from the USA, UK and Botswana.

Figure 7-15 shows the numbers of student thesis writers by their country of origin with the country of the institution that issued their degree.



	Students from Botswana	Students from South Africa	Students from other Sub-Saharan Africa	Students from Europe	Students from Rest of World
Degree from Rest of World	4	3	1		39
Degree from Europe	12	5	2	27	20
Degree from South Africa	4	32	2	1	3
Degree from Botswana	3		1		

Figure 7-15 Country of student origin by country of degree granting institution (n=159)

South African students tended to produce their theses for South African institutions and Europeans for European institutions. Students from Botswana and other African countries produced more theses for European institutions than for institutions in Africa or the rest of the world, as shown in Figure 7-16.

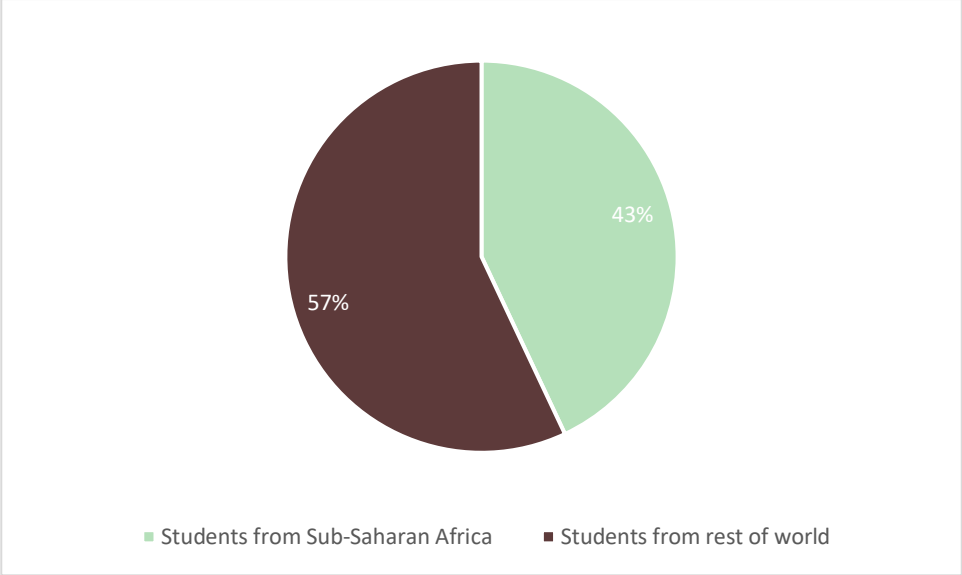


Figure 7-16 Percentage of students from Sub-Saharan Africa region

Forty-three percent of the thesis writers associated with permits were from countries in Sub-Saharan Africa: Botswana (26), Kenya (2), Namibia (2), South Africa (44), and Zambia (2), indicating that a significant proportion (43%) of the theses produced under the studied permits were written by students with home countries in sub-Saharan Africa.

The following Figure 7-17 groups the higher degrees issued for theses produced under research permits (leaving out Bachelor's level degrees at 10%) by three global regions.

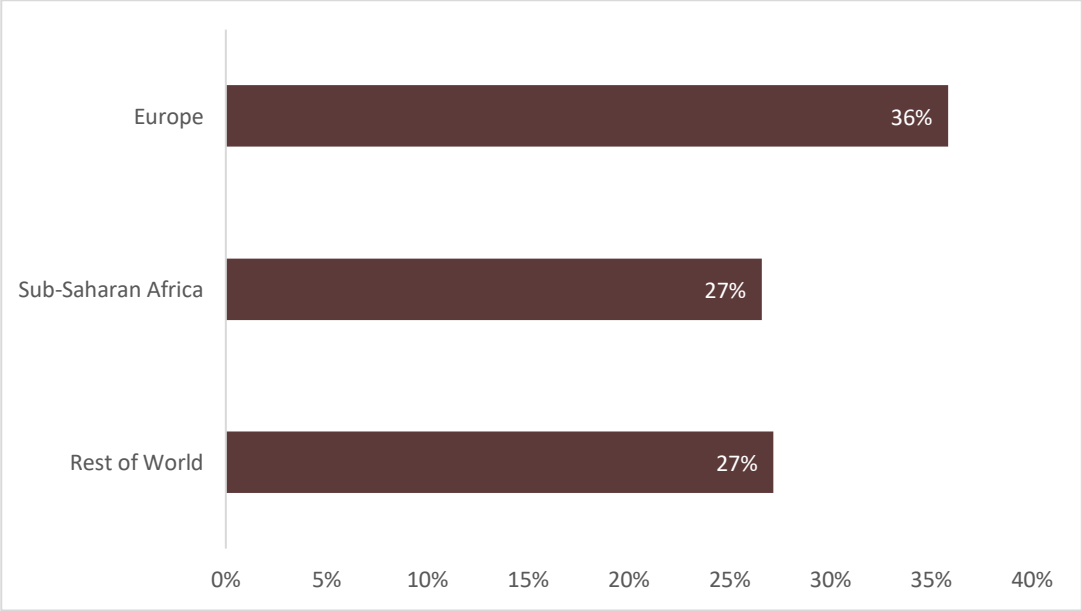


Figure 7-17 Higher degree theses by global region (n=155)

Theses from degree-granting institutions in Europe were associated with more research permits (36%) than were institutions in Sub-Saharan Africa (27%) and the rest of the world (27%).

7.3.2 Indirect capacity building outcomes

While the production of theses as outputs of the Botswana research permits studied resulted in capacity building for the students who carried out their studies under permit, the theses produced also had the potential to influence knowledge more broadly, and to build capacity beyond that of those who directly participated in the original Botswana work.

7.3.2.1 Broader influence of research permit outputs

What was the broader capacity-building influence of the studies produced under the research permits studied? Were these outputs, including theses, produced under permit, used by others? Did the process of capacity building of students extend to influencing those writing theses not related to the original research permits?

To examine these questions, an author and title search of Google Scholar was carried out for the 1138 original outputs from the studied research permits. The search found 825 of the 1138 original documents (73%). 313 (28%) of the 1138 were not found in Google Scholar. The search process identified that 707 of the 825 documents found in Google Scholar were cited by other documents in Google Scholar: in other words, the content of these outputs was used to support the findings and analysis carried out by other researchers not necessarily connected with the Botswana research. Figure 7-18 illustrates this finding.

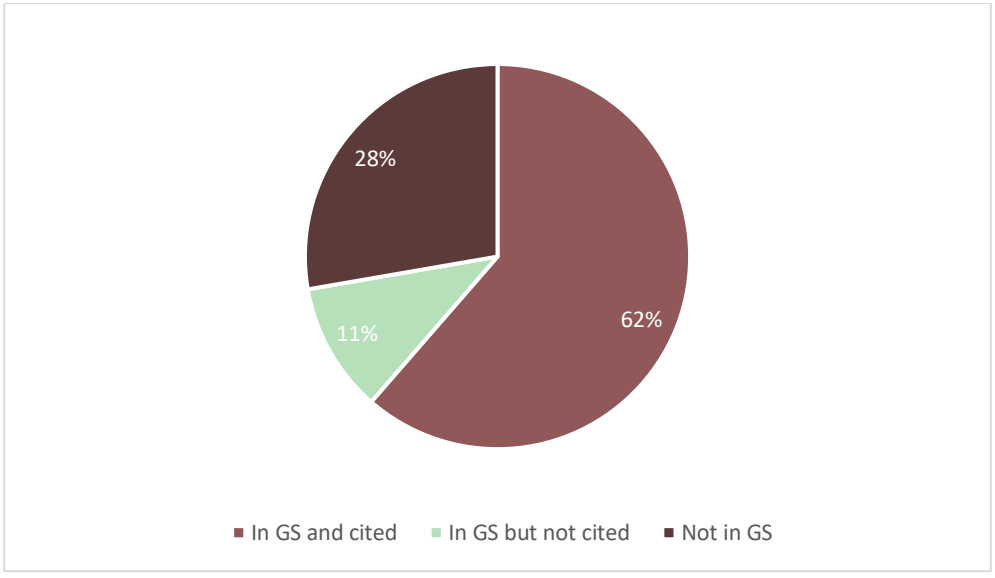


Figure 7-18 Google Scholar (GS) search results for outputs (n=1138)

Figure 7-19 shows the breakdown by document type of the 707 original outputs that were found in Google Scholar.

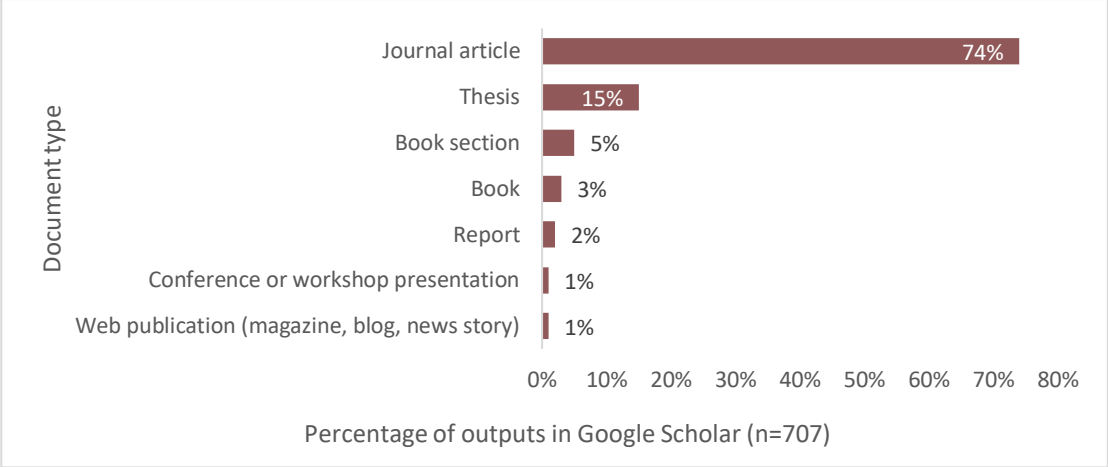


Figure 7-19 Types of cited document outputs found in Google Scholar

Two records were withdrawn from the dataset because the citing data contained errors, leaving 705 unique outputs from the research permits found and cited in Google Scholar. These 705 documents received 27,598 citations in Google Scholar.

The following Table 7-8 shows the research permit outputs that received at least one citation, by document type and number of citations received.

Table 7-8 Research permit outputs with at least one citation

Document Type	Outputs from Research Permits	Citations Received	Mean Number of Citations per Output
Journal article	523	22506	23
Thesis	103	845	12
Book section	33	526	63
Book	17	3014	56
Report	12	117	10
Conference or workshop presentation	10	39	3
Web publication (magazine, blog, news story)	7	551	79
Totals	**705**	**27598**	**256**

Journal article outputs were most highly cited by all citing document types, followed by book content, and then theses.

The following Table 7-9 shows the number of citing documents for each original output document type.

Table 7-9 Original outputs and citing documents

Original Output Document Type	Type of Citing Documents							
	Article	Book	Book Section	Conference Paper	Report	Web Content	Thesis	Other
Book	2348	133	224	23	38	1	212	36
Book section	322	16	67	5	15	2	99	0
Conference or workshop presentation	15	2	1	2	8	1	10	0
Journal article	15922	506	1485	305	507	33	3707	33
Report	78	4	10	1	8		15	2
Thesis	551	9	58	9	35	2	179	1
Web publication (magazine, blog, news story)	359	28	30	14	49	1	69	0
TOTALS	19595	698	1875	359	660	40	4291	65

Grouped under the *Other* category were bibliography, book review, conference proceedings, course description, course material, craft instruction, essay, government notice, image, lecture, patent, species record, and speech[29].

Of the citing documents, 4291 were identified as theses or thesis sections. Of these, 2624 were unique documents that sometimes cited more than one of the original research permit outputs. These were categorised manually by level of degree granted, country of academic institution granting the degree, and country or region that was the focus of the research.

Of 2624 unique theses that cited the original research permit outputs, 137 produced a Bachelor's degree, 931 produced a Master's degree, and 1556 produced a PhD degree. Figure 7-20 illustrates the breakdown.

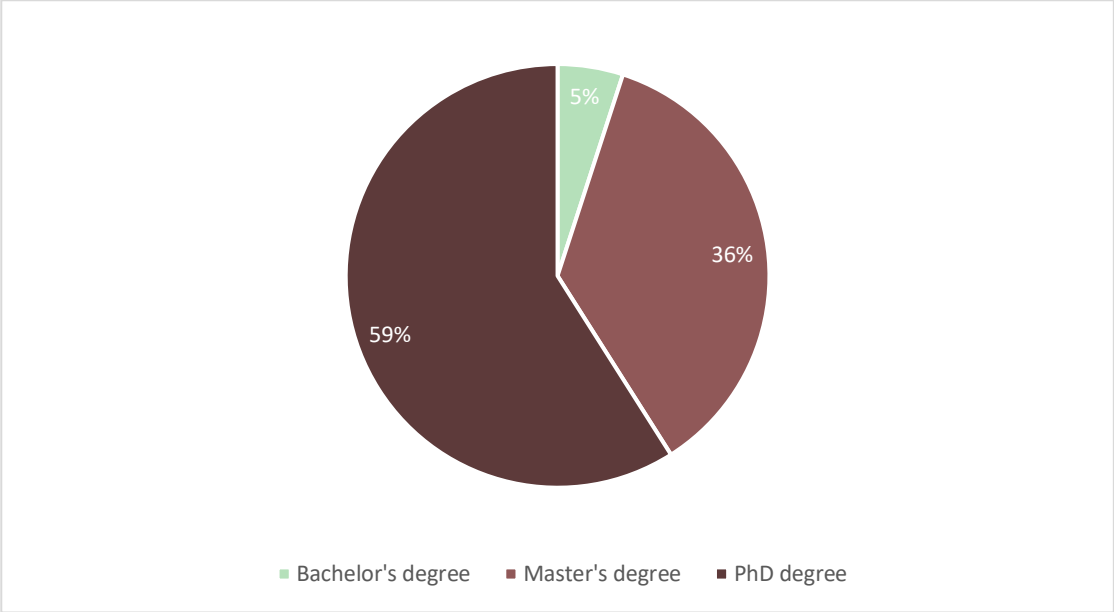


Figure 7-20 Qualification level of degrees citing original research permit outputs (n=2624)

Institutions granting the degrees for the 2624 unique theses produced represented 78 countries. Figure 7-21 indicates the percentage of degrees from the countries that issued more than 25 degrees (1%-28%). The map in Figure 7-22 shows *all* named countries where institutions granted a degree for the 2624 theses.

[29] It is important to note that this analysis is based on resources indexed by Google Scholar only. This means, for example, that portals and databases that may have cited relevant materials were often not included. For example, the Google Scholar search found only a few species records.

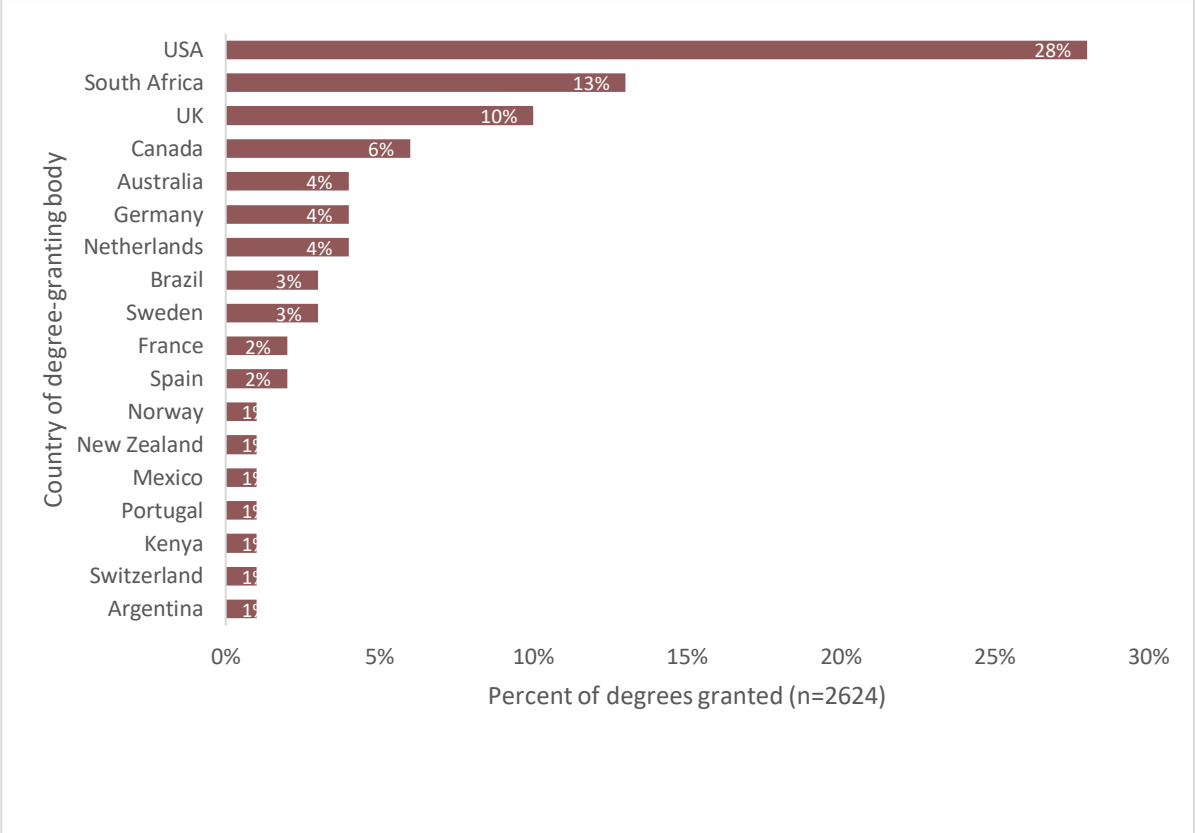


Figure 7-21 Countries of degree-granting institutions that produced citing theses

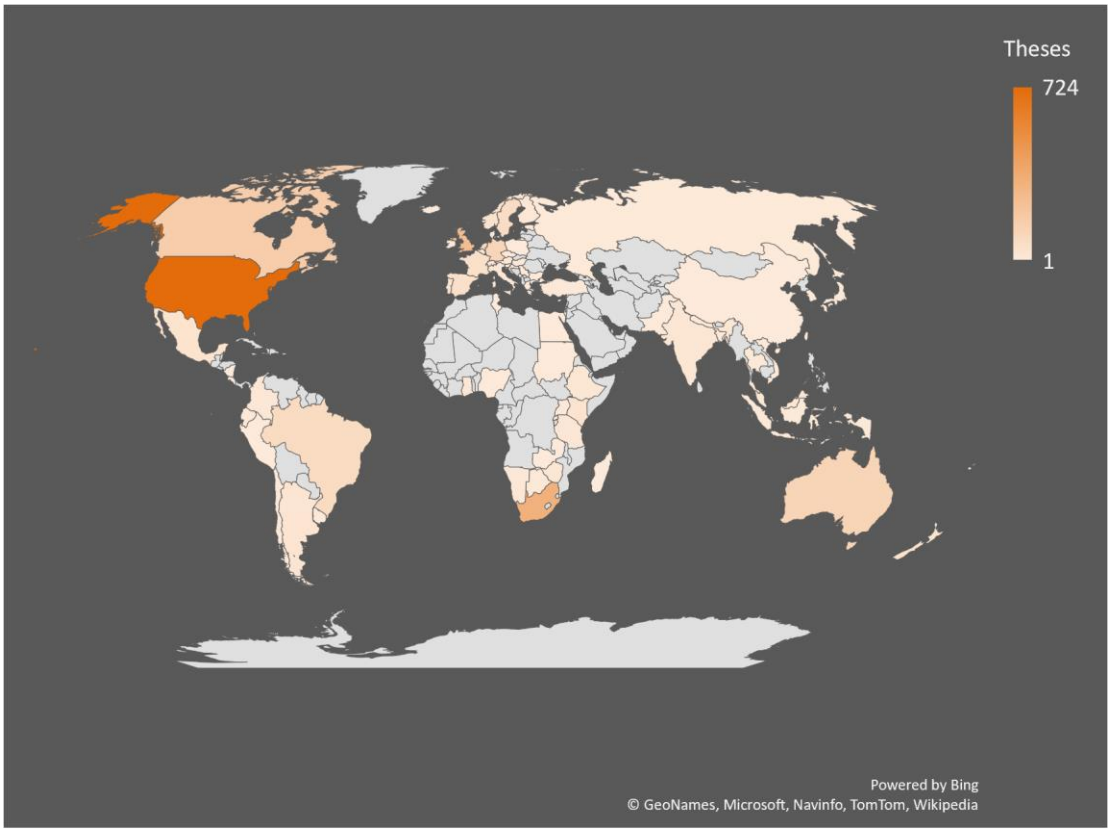


Figure 7-22 Map of countries of degree-granting institutions that produced citing theses

Institutions in the United States (28%), South Africa (13%) and the UK (10%) granted the most degrees related to the theses that cited the original research permit outputs. Most African institutions that produced the theses were based in southern or eastern Africa. It is also interesting to took at the geographic focus of the studies that produced the 2624 theses: did these studies, for example, add to knowledge of the African region?

One-hundred and sixty countries and, independently, 35 regions, were the focus of studies that produced these theses. There were 2691 mentions of countries or regions studied: some theses included more than one country or region. Of these, 241 theses did not specify a geographic region, as the studies were carried out in laboratories, or were based on models. These data are summarised in the six categories illustrated in the following Figure 7-23.

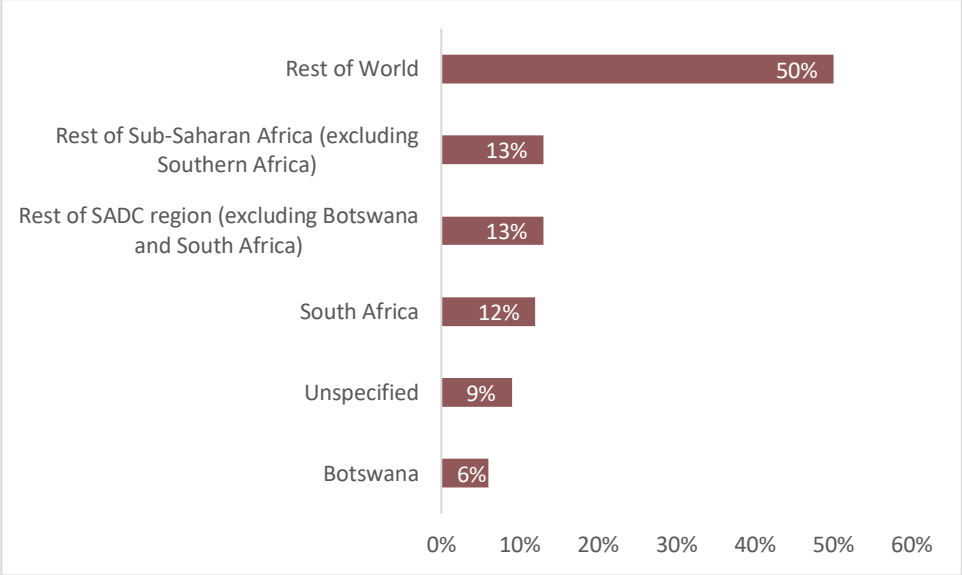


Figure 7-23 Geographic focus of citing theses (n=2624)

Half of the theses produced (50%) had a non-African country or region as their geographic focus, while 44% focused on Africa: Botswana (6%), South Africa (12%), the rest of southern Africa (13%), and the rest of Sub-Saharan Africa (13%). Nine percent of the theses did not specify a geographic focus.

The map in Figure 7-24 suggests the global geographic distribution of the studies carried out for specific countries. In addition to these countries, studies were carried out in the regions listed in Table 7-10.

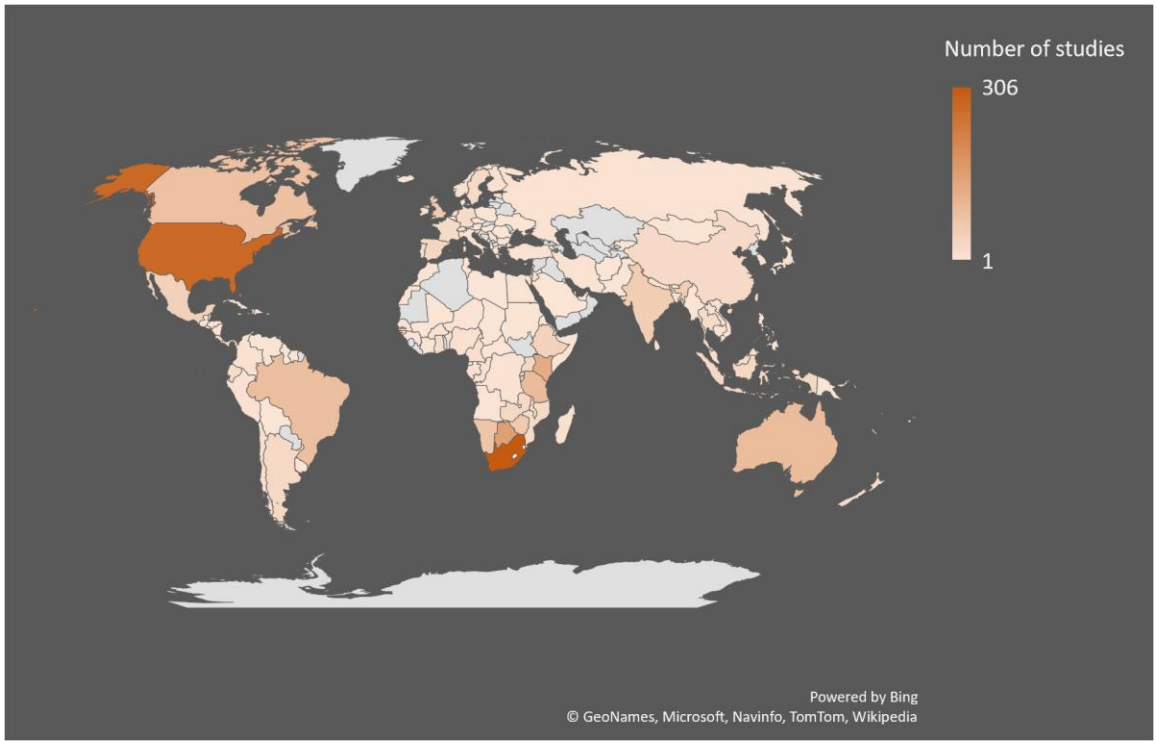


Figure 7-24 Map of 160 countries studied by citing theses

Table 7-10 Additional geographical regions studied in citing theses

Region	Number of studies
Africa	29
Asia	4
Central America	1
East Africa	5
Eastern Europe	2
Eurasia	1
Europe	15
European Union	1
Galapagos	1
Iberian Peninsula	1
Indian Ocean	1
International	57
Kalahari Basin	1
Mediterranean	3
Mediterranean Europe	1
Mediterranean Basin	1

Region	Number of studies
Middle East	1
North America	10
North Atlantic	1
North Sea	1
Northeast Atlantic	1
Northern Scandinavia	1
Oceania	1
Okavango River Basin	1
Patagonia	1
Scandinavian Peninsula	2
South America	4
South-Central Africa	1
Southeast Asia	2
South-East Asia	1
Southern Africa	43
Southern Africa	1
Southern Levant	1
Sub-Saharan Africa	5

7.3.3 Summary of direct and indirect effects of the research on capacity-building

Analysis of the 1138 research outputs produced under the studied Botswana research permits indicates that there were notable direct and indirect capacity-building effects from the work. For example, a significant proportion (43%) of the theses produced under the studied permits were written by students with home countries in sub-Saharan Africa, directly building knowledge and capacity of African researchers, and of those with whom they interacted throughout their research. Also, outputs from the research permits were used to support creation of 2624 theses, indirectly building capacity beyond that of those who directly participated in the original Botswana work.

Figure 7-25 illustrates direct and indirect capacity-building effects of the theses produced under research permit. Any permit output can, in theory, have both a direct and indirect capacity-building effect, or none, or only one of the two.

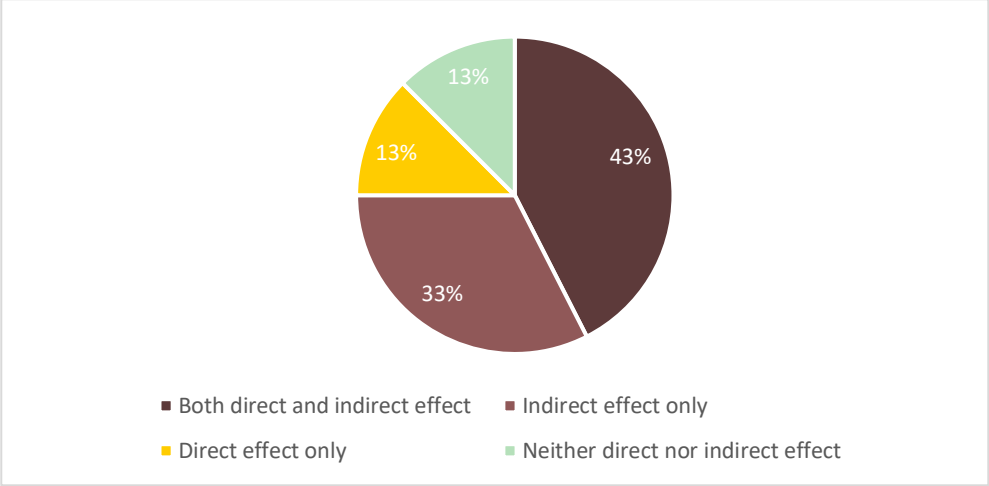


Figure 7-25 Direct and indirect capacity-building effects of theses produced under research permit (n=200)

There was no evidence from the data analysed that outputs from 13% of the 200 permits had either a direct or indirect effect on capacity-building because they were not found in Google Scholar.

Another 13% of the permits that produced theses can be considered as having had a direct contribution to capacity-building by virtue of the thesis work having been completed by the students who had gained new knowledge and skills in the process, even if the work was not used further.

33% of the permits had only an indirect effect because at least one of their non-thesis outputs was cited by a thesis in Google Scholar. Thus, one or more of the permit outputs informed another thesis somewhere else.

For 43% of the 200 permits, the relevant outputs had both direct and indirect effects in terms of capacity building. Each of these permits produced a thesis as an output and at least one of the outputs of the permit (which might be a book, journal article, thesis, or other) had been cited in another thesis recorded in Google Scholar.

Overall, then, 89% of the 200 research permits contributed to capacity-building uptake through direct (thesis production) or indirect (reading and citing) interactions. These interactions can be considered productive in that they led to further use of the research findings produced under the Botswana permits.

This analysis of outputs from the Botswana research permits demonstrates that the research capacity-building process does not stop when a thesis is finalised. Finally, Figure 7-26 illustrates that, when a thesis is shared, and its findings are used by other researchers, its influence grows through indirect interactions far beyond the institutional, topical and geographic boundaries of the original work, functioning as a boundary object in a broad community of practice.

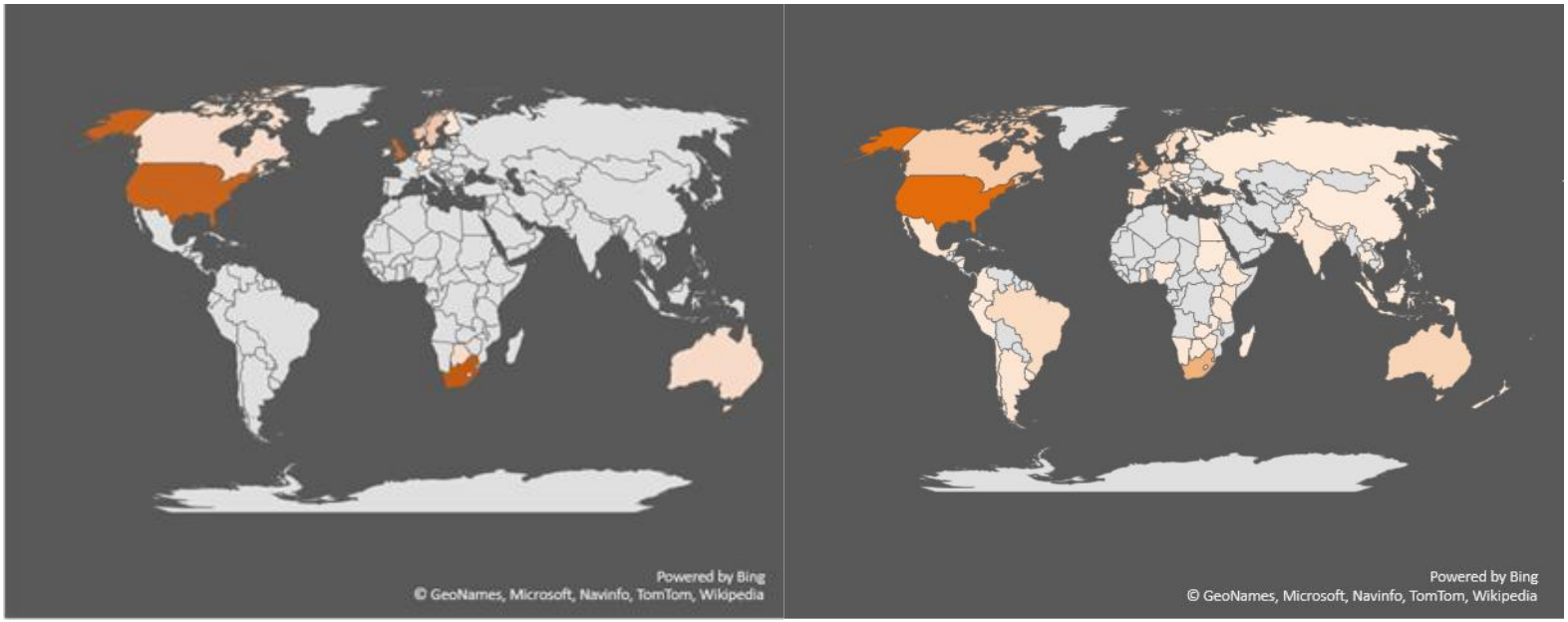


Figure 7-26 Comparison of countries of degree granting bodies for original research permit thesis outputs (left) and for citing thesis documents (right)

Chapter 8 Discussion and conclusion

8.1 Summary

This study set out to determine whether research carried out in or about Botswana has been focused on producing useful and used work in the area of wildlife and related natural resources, with a view to improving management of these resources. The thesis works towards this by investigating how uptake and use of wildlife research findings in northern Botswana may be affected by interactions of researchers and potential users of research.

The original focus of the study was on increasing understanding of the uptake of wildlife survey research in northern Botswana, towards the goal of identifying effective methods of communication between researchers and possible users of research. The concepts of community of practice and productive interactions were introduced to frame data collection in a process of surveys, interviews, and *ad hoc* participant observation. Analysis of the findings focused on identifying interactions among researchers and stakeholders that led to perceived uptake and use – referred to as contribution (as opposed to attribution) outcomes. These findings indicate factors that appear to support research uptake: early engagement of researchers and research stakeholders to ensure local relevance and awareness, ongoing exchange of data and knowledge to improve trust, long-term investment in a research location and its stakeholders, use of knowledge-sharing outreach platforms to increase understanding, and capacity building through involvement in research.

The investigation was able to describe a northern Botswana wildlife research community of practice made up of stakeholders from academia, local communities, the tourism private sector, management consultancies, and NGOs. This localised social system is characterised by mutual engagement, joint enterprise, and shared repertoire. Knowledge exchange within this community of practice takes place through planned and unplanned interactions, many of which can be described as productive and leading to uptake and use. Scholarly outputs from research carried out in this community result in development of more research capacity in Botswana, the region and across the globe.

Reviews of literature defined the elements that support research uptake. A review of the history of wildlife research in Botswana in Chapter 2 revealed a pattern of mixed stakeholder interactions and influences on a government-led research programme focused on game management. The literature provides evidence that the need for research to inform policy and management practice in Botswana has been acknowledged throughout the process of changing politics, paradigms, and methodologies. Chapter 3 set out the elements that have been found to support research uptake in conservation science and introduced the concept of productive interactions in communities of practice. Fieldwork identified a localised community of practice in northern Botswana. This work was described in

Chapter 4, which explained development of a methodology that came to focus on identifying routes to evidence for productive interactions and uptake through actively engaging and participating in these routes. Surveys and document content review substantiated presence of productive interactions within a community of practice, and bibliographic analysis revealed patterns of connection and influence for research outputs based on Botswana research. Chapters 5, 6, and 7 describe the result of three Botswana case studies that used different methods to point to research uptake: a government regulatory process, a public outreach event, and scholarly outputs related to the production of theses and dissertations. This final chapter discusses the findings presented in the previous three chapters in relation to the objectives of the thesis.

This chapter consists of eight sections. Following this summary, Section 8.2 examines the work's original objectives and research questions in the light of what was discovered during the research process. Section 8.3 reviews the findings of the empirical chapters 5,6, and 7. Section 8.4 provides some insights based on findings. Section 8.5 suggests actions derived from the study that might work for wildlife stewards and other research stakeholders in Botswana in improving the uptake of research. Section 8.6 explores whether the findings of this work can increase understanding of the fields of research uptake, science-policy interface, and knowledge exchange research. Section 8.7 discusses some limitations of the study and provides recommendations for future research. Section 8.8 draws the work of the thesis to a conclusion.

8.2 Revisiting the objectives and research questions

> I[nformation] T[echnology] has been applied to ecology along two separate lines: (1) it has been used to quantify the distribution of stocks and numbers of organisms and (2) it has been used to quantify the pattern of interactions of trophic processes. By and large, the first endeavor has resulted in relatively few insights into ecosystem dynamics and has generated much ambiguity and disappointment … (Ulanowicz, 2001, p. 393).

The major difference between the original objectives and research questions intended for this study, and the findings, is the somewhat broader interpretation of wildlife survey data that evolved throughout the study. Originally driven by controversy surrounding a specific set of aerial survey data that indicated decline of wildlife in northern Botswana, and stimulated by the author's background in information science, the emphasis on primary population surveys was intended to provide a manageable focus for the research. As the study progressed, it became apparent that wildlife inventories and monitoring activities, while understood to be fundamental in the management of wildlife resources, were not in themselves indicative of the full range of interactions that take place between researchers and wildlife stakeholders, interactions that might indicate potential for future use of the research. In fact, animal counts and other field survey data appear to function as boundary objects that enable – because of their apparent simplicity to non-scientists and

the associated implication of ‘too many’ or ‘decline’ – conversations among researchers themselves and between researchers and other stakeholders. In short, the focus of the study became people, rather than information. As pointed out in Chapters 2 and 4, questions and observations about survey and monitoring data appear throughout my investigations in this context.

The objectives of this study, related research questions, and some indicative findings are set out in the following table.

Table 8-1 Objectives and research questions

Objective	Questions	Some related findings	Section
1. To describe and investigate the nature of communities of wildlife research and practice in Botswana, including the interactions of stakeholders, as informed by two real-life cases: a government system that regulates research, and a mechanism for research outreach in the form of a public event	Who are the research stakeholders in wildlife research in Botswana, and what is the nature of their roles and interest?	Botswana citizens are visible members of the northern Botswana research community of practice	Sections 4.3.2.3 and 5.7.1
	With whom among these stakeholders do researchers interact?	Researchers interact with many other stakeholders, but most with other researchers	Section 5.5.2.1
	What kind of interactions take place between researchers and other stakeholders?	Discussions of methodology, inclusion in research, and meetings are most common interactions during research fieldwork, and all lead to more uptake	Section 5.5.2.1
	What characteristics of researchers and other stakeholders affect how they interact with one another?	Graduate students and NGO researchers are most likely to present interim findings to others	Section 6.2.3
2. To investigate whether and how wildlife research findings generated by researchers working in Botswana have been	What types of research data and information, and in what form, are shared among researchers and other stakeholders?	Researchers and stakeholders who are wildlife stewards frequently share data and information ad hoc	Section 5.5.2.3

Objective	Questions	Some related findings	Section
shared and taken up, as informed by the two real-life cases above	Does sharing of research data and findings lead to uptake and use?	Perception of use of research is positively related to active sharing of data and information	Section 5.5.2.3
	What researcher characteristics affect the uptake and use of their research?	Private sector and NGO researchers, and natural scientists perceived the most uptake	Section 5.4.1
		Researchers who believe their research was relevant also perceive that it was used	Section 5.6
	What other conditions affect the uptake and use of Botswana research?	Research planned with local knowledge, including management plans, results in more uptake	Section 5.5.3
		Research carried out over a longer-term results in more uptake	Sections 5.2.4 and 5.7.4
3. To critically reflect on channels, tools and methods that could support productive interactions and effective uptake of wildlife research findings in Botswana**.**	Can regulatory systems support productive interactions?	Existing regulatory systems weakly support researcher-Botswana government stakeholder interactions	Chapter 5
	Can public outreach platforms support productive interactions?	Stakeholders, and to some degree, researchers recognise the value of interactions at public outreach platforms, and believe they support uptake	Chapter 6

Objective	Questions	Some related findings	Section
	What types of tools and methods used to share research findings in Botswana are most effective in supporting effective uptake?	Researchers view scholarly publishing as most effective communications method	Section 5.5.3
		Researchers who use a variety of communications methods report more uptake	Section 5.5.3
4. To analyse written acknowledgements in student theses and dissertations as possible pointers to productive interactions in the execution of wildlife research in Botswana	Does the content of written acknowledgments reflect productive interactions between researchers and other stakeholders??	Researchers who acknowledge others perceive more uptake of their research	Section 7.2.1.2
5. To investigate both direct and indirect capacity-building uptake effects of research on wildlife in Botswana, based on a classification of research outputs and citation analyses of such outputs	Can outputs from research carried out in Botswana be used as evidence of capacity-building?	Use of Botswana research outputs indicates interactions that lead to uptake through capacity-building	Section 7.3
	Is wildlife research carried out in Botswana building the knowledge and skills of African researchers?	Botswana-based research is contributing to capacity-building in the country, region, and continent	Section 7.3

8.3 Findings

The following three sections discuss findings of the work in relation to the objectives.

8.3.1 Objective 1: a community of interactions

> … our findings suggest a collaborative path that creates an implementation space open to various stakeholders. In such a space, partners can negotiate meanings, co-design initiatives, innovate measures, and in this way enhance the likelihood that their shared undertakings will achieve concrete, measurable conservation and environmental quality outcomes (Ardoin, Bowers, & Gaillard, 2020, p. 11).

> In the Okavango, locals are scathing of the many researchers from international universities who come to conduct projects on aspects of the environment, and yet are at times unable to drive a four wheel drive vehicle navigate the complex environment, or manage encounters with dangerous wildlife, and so depend heavily on local assistance (Gressier, 2015, p. 165).

8.3.1.1 Northern Botswana's researchers and stakeholders

I first explored the nature of communities of wildlife research and practice in northern Botswana, including the interrelationship of stakeholders and their use of survey data, through the initial exploratory work I carried out in 2014. Some of the following description of Botswana's wildlife research community of practice is taken from the report of this work to provide context for the findings of Chapters 5 and 6.

The findings described in the following section indicate, overall, that interactions between these researchers and stakeholders in northern Botswana have led to positive outcomes that can be considered contributions to uptake and use.

The boundaries of individual communities of practice and their sub-communities can be opened or crossed through encounters, objects and intentional or accidental intermediaries (Cash et al., 2002; Guston, 2001; Kallis, Kiparsky, Norgaard, Lejano, & Ingram, 2009; Mollinga, 2008; Sternlieb, Bixler, Huber-Stearns, & Huayhuaca, 2013; Wenger, 1999). In northern Botswana, the most common activities that function as boundary spaces — where stakeholders in wildlife from different sectors share their experience — are workshops, public consultations, research consultations, and participation in externally funded projects.

Review of a cross-section of stakeholders represented at Botswana wildlife research workshops in the exploratory phase of this thesis work showed that these fora function as a forum for interactions across sectors, led by government and parastatals and followed by consultants, local NGOs and research institutions, INGOS and cooperating partners, and tourism safari operators (Morrison, 2014).

It is the norm in Botswana for social science researchers to adopt a participatory research approach in both data collection and dissemination of research findings. This often involves organising meetings at the community or sub-community level. Those who are studying wildlife in the context of local livelihoods frequently adopt methodology that feeds their findings back to the communities that provide the raw data. They consider it part of the ethical requirements of their work to give back to the people who have helped them, but also, since some carry out action research, they want to see uptake of their findings (Gupta & Kelly, 2014; Larocco, Shinn, & Madise, 2019; Mbaiwa, Thakadu, Moleele, Stone, & Stone, 2011).

International cooperating partners provide project funds to carry out work that might be otherwise delayed or not completed by under-resourced government units, research institutions, and NGOs. They also have reporting requirements that make it necessary to tell others about how the project is progressing.

While Botswana's consultative and collaborative culture has nurtured what appears to be a wildlife research community of practice, there are still lines drawn based on mutually exclusive – and sometimes adversarial – points of view. There are the pro- and anti- hunting lobbies (Badenhorst, 2003; Gressier, 2012), those who argue that capture and release of wild animals by biologists has a negative impact on the tourism industry **[E025]**, those who object to the manipulation of animals to attract visitors or enable research (Personal communication, 2012), and those who object to voluntourism – charging fees to untrained volunteers to participate in monitoring and research **[E011]**.

Another perceived division is between Botswana residents and independent foreign researchers. Expatriate scientists bring a strong sense of urgency and pre-determined focus to their fieldwork. Their research permits are hard to get, and time limited, as are their research grants. They can be critical of the amount of time it takes to get what they think are important tasks done, sometimes expressing the opinion that local researchers and government managers do not care enough about vital conservation tasks, or simply that they are not good at their job **[G018]**.

Some in the safari industry feel a divide between their industry and government officials **[E010]**. Then again, some government managers feel that foreign researchers are not really adding value to their management efforts **[G029, G010]**.

Nevertheless, boundaries are crossed, alliances are forged and people from different groups do talk to one another. Advice is sought across sectors, responses made, discoveries defended, and outputs shared in a process that resembles the interactions of a large, somewhat unruly, and argumentative family. While the flow of information is not linear, and always predictable, it takes place in the form of Etienne Wenger's functional categories of mutual engagement, joint enterprise, and shared repertoire.

8.3.1.2 Nature of the interactions in the community of practice from empirical studies

Empirical work for this thesis revealed that researchers were supported throughout the research process through a series of productive interactions that involved forming and strengthening relationships with other researchers and stakeholders. Who were the community members, and how did they interact?

Communities of wildlife research and practice in northern Botswana, including the interrelationship of stakeholders and their use of survey data, were examined through the study of DWNP research permits described in Chapter 5, the investigation of a public outreach event in Chapter 6, and the study of acknowledgments in Chapter 7. The findings indicated a rich variety of interactions through the research 'pipeline' that appear to have led to other interactions, and in some cases, use.

Figure 8-1 Research Talks for Everyone, January 2018

The findings of the study of the structured platform, *Research Talks for Everyone*, support the initial observation that the northern Botswana research stakeholders studied make up an identifiable community of practice, whose interactions produce resources that affect their practice. The longevity of the event, the degree of positive interest expressed by attendees, and evidence of collaborative outcomes among the representation of research stakeholders who attend the Talks point to a loosely knit network or community that shares knowledge selectively, based on overlapping interests. The platform can be seen in itself as a productive interaction in that the event has led to further engagement with the research presented. Interactions associated with the event can be viewed as contributing to conditions that are understood to nurture research uptake: awareness, access, relevance, trust, and understanding.

Types of most common interactions vary according to type of stakeholder engaged, but all interactions lead to more uptake

Across the five groups of stakeholders highlighted in the research permit survey, discussions of methodology, inclusion in research, and meetings were the most mentioned interactions during research fieldwork, but their use varied according to type of stakeholder engaged.

Most discussions of methodology, and inclusion in research took place with other researchers. Interactions with other stakeholders such as the DWNP, community members, and NGOs were most common in the form of meetings. Most interactions with community members took place through interviews, and employment of community members as guides and logistical support staff. The survey data showed little difference among categories of stakeholders: any researchers who interacted with others indicated higher confidence that their work had been put to use.

A strong and interactive role for NGOs

Interestingly, while most research permit holders reported more interactions with other researchers, government officials and communities than with Botswana-based NGOs, findings of the *Research Talks* study indicated a strong and interactive role for NGO researchers. This may be because the research permits study was limited to work carried out only until 2014, while the *Research Talks* study looked at more recent conditions where NGO, institutional and private researchers interact more frequently.

Graduate students and NGO researchers are most likely to present interim findings to others

The *Research Talks* study found that graduate students and NGO researchers reported most participation in the Talks in the roles of both audience member and presenter. This was the group that also reported the most follow-up with presenters, indicating a higher level of engagement with the overall process of the event.

Botswana citizens are visible members of the community of practice

Batswana were not only engaged in wildlife-related research, but foreign research permit holders had opportunity for interactions with Botswana researchers – and with that, the networking opportunities with other stakeholders based in Botswana – throughout the research process. Both these conditions allowed for early engagement of local stakeholders in priority setting and planning, including participation of Batswana students. The BONIC project in the Chobe region included two DWNP officers as graduate students, and work carried out by Botswana-based NGOs Kalahari Research and Conservation and Ecoexist, for example, included Batswana graduate students in projects led by non-citizen researchers (Skarpe, 2002) **[G019] [RP018].** But Botswana citizens enrolled in tertiary institutions outside Botswana also held research permits during the studied period.

Interactions appear to lead to uptake

Research permit survey responses from 128 principal investigators issued DWNP research permits between 1996 and 2014 revealed that researchers who interacted with others indicated higher confidence that their work had been put to use, irrespective of the category of stakeholder involved.

While interactions with other stakeholders were common, researchers tended to interact most with other researchers

Most common interactions that principal investigators had with during fieldwork were inclusion in research, and discussions of methodology, most of these with other researchers. Interactions with other stakeholders such as the DWNP, community members, and NGOs were most common in the

form of meetings. Most interactions with community members took place through interviews, and employment of community members as guides and logistical support staff.

Other researchers also appear to have been most important in assisting researchers in the field, followed by funders and government officials. Community members were mentioned less frequently. The most common types of support and assistance provided by those who were identified as influential in success of researchers' fieldwork were reported as access to research location, knowledge, and logistical support. Many written acknowledgements of stakeholders from the researchers studied were related to support in challenging fieldwork conditions. Interactions of researchers with local communities were largely related to location access and provision of local knowledge, with reciprocal arrangements in the form of employment of translators and logistical support staff, indicating a range of power relationships, with opportunities for multi-directional flow of knowledge. For those respondents who perceived a contribution outcome, there was a positive association with acknowledging assistance from both academic and non-academic stakeholders, indicating that the interactions implied by the acknowledgements were productive.

8.3.2 Objective 2: facilitating uptake

> The practices and techniques of identifying and locating the biological values are thus not viewed as resources for decision-making but as performative of the partnerships in environmental governance, shaping the roles of science, corporations, government and civil society. (Peltola, 2013, p. 29)

How factors such as linkages among actors, indicators and other communications methods affect the uptake of wildlife survey data was explored through the work described in Chapters 5, 6 and 7, which showed that mutual engagement (relationships among members of the community), joint enterprise (working together at the point of problem), and shared repertoire (communication based on shared meaning) were all present and leading to productive interactions in the northern Botswana research community of practice.

Perceptions of principal investigators as to the uptake and use of their research were explored through the research permit survey. While most research permit holders surveyed said that they did not know if their research had been taken into use, those who perceived that it had also reported more and a wider variety of interactions with stakeholders.

Findings of the *Research Talks* study support the theory that productive interactions – those engagements that result in further engagement – lead to more uptake of research in a staged continuum of varied responses. These responses in themselves appear to often lead to more responses.

Private sector and NGO researchers, and natural scientists, perceived more uptake

Of those who did perceive that their research was used, researchers in the private sector and in NGOs more often perceived uptake, while researchers in institutions perceived little or none.

Responses from researchers in the natural sciences showed a pattern of greater confidence in the use of their research than did those from social scientists. This could indicate that social scientists are still finding their feet in a field and location traditionally dominated by biologists, that the research questions posited by social scientists are more complex, or that application of research findings is more difficult when managing people than with managing wildlife.

Researchers whose planning was based on familiarity with Botswana conditions perceived more uptake into use

A pattern in survey responses was that the largest gap between researchers who felt that their research had been used and those who did not, or those who did not know, was for those whose research project motivation was one of the following: an observed problem, or a priority identified in the DWNP research strategy or other accepted management policy. Others mentioned specific management policies and practices to which they wished to contribute: “These monitoring objectives were put forward in the Nile crocodile management plan (2007) developed for the DWNP by the Okavango Crocodile Research Group (2002-2007)” **[G0005]**. These permit holders had decided to study the topic because of their indirect or direct interaction with Botswana stakeholders, determined by knowledge of DWNP research priorities and/or needs identified by previous research in the country. This could indicate that there is a relationship between relevance to potential users of research and actual use of the findings.

Researchers with long-term engagement in the region reported more uptake

Perhaps one of the most important findings of the work was the correlation of long-term commitment to research in the region and perception of uptake. More researchers who were still working in Botswana in 2018 reported a contribution outcome for research carried out under their research permits than did those who completed their research and left the country during the period studied. Long-term engagement with a research location, and its people, improve the likelihood that research is relevant to the needs of potential users, as more familiarity with the physical and social environment provides more opportunity for productive.

An example of long-term engagement carried out through graduate students is that of a biologist from the United Kingdom university, who carried out only a few fieldwork trips to Botswana but continued to engage with the region by encouraging his graduate students to do their research there. Over the years, at least four of these students committed to long-term engagement with northern

Botswana by forming Botswana-based research NGOs or trusts there. While it is clear that this has led to interactions with a cross-section of stakeholders, including government and communities, whether the Botswana-based NGO created by non-citizens is a welcome and sustainable method of engagement remains to be seen:

> *"The private research NGOs will need local structures which can help them penetrate policy makers. I see their role as linkage agent being limited by the fact that they do not have adequate connectivity to policy makers. Therefore their role and focus should on high quality scientific research and packaging of research results in a manner palatable to research users. They should more than anything conduct research which will influence 'practice'. Not much on policy because that takes a lot of time. They should focus on research that addresses real life problems."* **[Former academic researcher now working as a project manager (G028)]**

Much data sharing was ad hoc, and researchers who shared data, information and knowledge throughout the research process perceived more uptake into use

The process of collecting, processing and analysing data collected in the field offers multiple opportunities for productive interactions between wildlife researchers and stakeholders. The investigation showed that sharing or exchange of raw data among researchers and stakeholders, including institutional stakeholders, was common. More than half of all respondents to the research permit survey indicated that they used data from other sources to support their work. Both researchers who indicated a contribution outcome and those who reported that they were uncertain as to whether their research findings had been used, reported more use of others' raw data than those who indicated little or no contribution outcome.

Most researchers reported that they shared their own raw data with others. Institutional policies appeared to have motivated more sharing across all stakeholder groups. Direct requests for data were the most common reason for sharing with other researchers, NGOs, and private sector stakeholders. Researchers' personal preferences also accounted for researchers' sharing of their data across all categories of stakeholder, mostly in the case of other researchers. About a third of research permit survey respondents reported that they knew that the data they shared had been re-used by others. Those who reported most that they had shared their data were also those who claimed a contribution outcome for their research, while those who reported the least sharing were respondents who felt their research had not been used at all.

Survey respondents who had indicated a contribution outcome overall appear to have shared their analysed findings with stakeholders more than those who indicated little or no contribution outcome.

Government officials, including DWNP, were the most common recipients of research findings, followed by other researchers and Botswana research institutions. Less than a third reported sharing

with memory institutions such as libraries and archives that are responsible for long-term preservation and access. This finding supports the 2014 review of items held by the University of Botswana's special collection of Botswana research outputs that found less than 30% of such outputs captured by the library (Morrison, 2014). While the indirect interaction of submitting final research papers to national institutional repositories is mandated in Botswana's policy for research permits, and, according to interviews with independent researchers, usually carried out, these findings indicate a fault in the country's knowledge infrastructure.

Research planned with local knowledge, including management plans, results in more uptake

Unexpectedly, those researchers who indicated a contribution outcome reported less use of Botswana government documents than those claimed that they did not know if their research had been put to use, and, in some cases, less use than those who indicated a negative contribution outcome. Government documents used most by those who indicated a positive contribution outcome, though, were management plans and project reports, documents closely related to planned and ongoing activity. This could indicate that information highly relevant to local management conditions was selected over other information for use by researchers who then went on to see their work used.

Researchers who believed their work was relevant also perceived that their work was used

Those researchers who perceived a contribution outcome also indicated that their work was relevant at most levels – the community, country, region and internationally. Those who claimed that they did not know if their research had been put to use also, for the most part, judged their research relevant at most levels. Those who perceived a negative contribution outcome indicated more often that their research was not relevant.

8.3.3 Objective 3: channels, tools, and methods

> … to communicate the implications of biodiversity loss … can be most effective when conservation scientists find ways to demonstrate connections that resonate with a target audience. (Lees, Attwood, Barlow, & Phalan, 2020)
>
> Using the mass media, posters, illustration materials are frequently used communication tools in nature conservation. But they are produced without proper analyses of the real means for solving a certain problem. Which communication tool is the proper means to use can vary enormously from situation to situation. In fact we often forget that the most powerful tool is a face to face conversation. (Szucs, 2005)

Communication tools and methods that support effective uptake of wildlife research data were examined in all three empirical chapters. Chapter 5 captured the responses to questions about types of materials produced and channels used for sharing principal investigators' findings. Chapter 6 looked at a specific outreach platform where researchers presented their work to a broad audience,

and Chapter 7 returned to conventional scholarly outputs in the form of theses and dissertations to examine a specific type of uptake, the development of research capacity.

Deliberate efforts to share knowledge about research activities and findings with stakeholders beyond academia are among the most easily acknowledged and tracked productive interactions. They build awareness by helping potential users know the research exists, expose opportunities for collaboration, increase relevance by helping researchers learn what potential users think is important to them, build trust through creating and strengthening relationships and exposing researchers to public policy concerns, and increase the potential for improving understanding by giving researchers practice in communicating to non-scientists.

Researchers recognise the value of communicating beyond academia

Early findings of this study indicated that researchers are both aware that they need to communicate their research beyond academic audiences and are open to using different tools and channels. The major impediment to their doing so appears to be the need for academic researchers to produce publications for the peer-reviewed literature, which takes most of their time and effort. An NGO research project manager put it this way:

> *"Managers and practitioners are most important [audience]. But now when I am looking for big grants, because I haven't focused on peer-reviewed publications, I lose out. How do you measure impact? When I have focused on engaging with policy makers and farmers, we have been ignored for years."* **[E009]**

Joubert (2018) emphasises the importance of objectives in science communication: "… unless these objectives are clear beforehand, it is not possible to determine later whether a particular activity was successful" (Joubert, 2018). In the case of researchers in northern Botswana's wildlife research community of practice, a professional objective in communicating a researcher's work to stakeholders outside academia is to make the case for particular approaches to conserving wildlife, while more a social objective is maintaining good local relationships that support access to areas and resources. The challenge for these researchers is to communicate alignment of the first of these objectives with the vested interests of stakeholders and, for the second objective, to maintain an ongoing reciprocal knowledge exchange process that acknowledges those interests. Productive interactions can be seen to meet these challenges.

Formal systems failed to robustly support interactions between researchers and the country's main wildlife steward

While survey results indicated that researchers who perceived a contribution outcome reported more to the DWNP, low rates of both formal reporting of research progress, and of feedback between

researchers and government officials would seem to indicate that there is considerable scope for this part of the permit process to increase interactions.

Researchers view scholarly publishing as the most important communications tool

For the most part, research permit holders shared their analysed results in the form of a copy of a thesis or scholarly publication. Close to half of those responding had made live presentations of their findings, and a quarter reported that they had shared their results at a workshop or in the form of a lay summary. Very few reported use of communications channels other than these.

The greatest number of research permit survey responses indicated that scholarly publishing was considered most effective communications tool, possibly indicating the importance these researchers place on what they consider their core business: production of new scientific knowledge.

Researchers who used a variety of communications channels to share their findings perceived more uptake of research

Respondents who had indicated a contribution outcome for their work used more of the four most common formats to share their findings. While all three categories of researcher (those with a contribution income, with no contribution outcome, and those who just did not know) often reported sharing a copy of an article or thesis, the positive contribution outcome group was clearly more active in using the additional direct interaction formats of live presentations, workshops, and indirect interaction format lay summaries. Respondents who indicated a contribution outcome used most channels more than those who indicated little or no contribution outcome, and reported more use of non-academic communication channels, submissions to government commissions, and follow-on collaborative work than did respondents who were unsure that their work had been taken into use.

Presentations were the most used method for sharing analysed results, and the popularity of this channel among researchers was also evident when respondents were asked, for the entire cycle of their research activity in Botswana – from planning to dissemination – what they considered the most effective channel for sharing their work.

Although not mutually exclusive, there were those who felt that their work was focused on furthering scientific knowledge in general maintaining that indirect interactions through peer-reviewed journal articles were the most effective way of sharing their research, those who wanted their research to inform a specific field of conservation activity such as species management focusing on indirect methods such as contributions to international biodiversity indicators, and

those who felt it was most important to apply their research to local issues seeing direct interactions in the form of presentations at workshops and public consultations most effective.

Those who indicated lower use of channels other than that of scholarly publishing, showed decreasing perception of use of their findings.

Stakeholders and to a lesser degree, researchers, recognise the value of public outreach platforms

The study of *Research Talks for Everyone* in Chapter 6 validated the effectiveness of the format of the informal public outreach platform. The longevity of the event indicates that it has filled a gap in responding to the local perception that access to information about research carried out in the region is limited, and that researchers are unwilling to share their knowledge, acting as a counter to the ubiquitous *Do Not Follow* sign on research vehicles frequently seen in Maun village.

Public outreach events support productive interactions

The findings of the *Research Talks* study indicated that this type of platform supports productive interactions that can lead to use. While the event itself can be considered a productive interaction, specific resulting interactions identified were direct follow-up by audience members with presenters, direct and indirect sharing what was learned at the event with others, and indirect use of summaries post-event.

Patterns of follow-up indicate a lack of reservation on the part of many non-academic stakeholders to engage with experts: a condition for equitable interactions. Professional researchers who were staff members of institutions seldom followed up with presenters. This indicates a lower level of engagement, a reluctance perhaps caused by fear of competition or criticism, although another reason might be because these researchers knew they had other opportunities in professional settings to engage with the presenters and their research.

Based on the perceptions of survey respondents, analysis of these interactions resulted to some extent in uptake through changes in thinking and behaviour, and to use. What is learned at the Talks is being used by attendees at work to inform colleagues and staff, to apply new methods, and to make networking connections. This also applies to the use of summaries distributed post-event, where an indirect interaction in the form of the written summary led to a direct interaction in the form of a sharing event. Some interactions at the Talks resulted in collaborative activities, either through application of the research methodology in other settings, or through requests to researchers to share their work further.

Chapter 7's analysis of thesis acknowledgements and of a specific communication process, the dissemination of thesis and dissertation content, provided evidence of productive interactions that led to uptake in the form of capacity-building. As boundary objects that link the field experience of students with broader areas of research, these documents both documented productive interactions that were not otherwise captured in a codified way and influenced more interactions that led to use. The first part of the study that examined the content of written acknowledgments in theses and dissertations showed that these can be a useful proxy for the interactions described. Intended as missives to members of the community of practice as experienced by the student researcher, the medium of written acknowledgments is a vehicle for understanding the research experience, and for building on the relationships established during the research process.

The second section of Chapter 7 looked at whether theses and dissertations created under research permit in Botswana were indicators of uptake in the form of capacity development. The communications process described was embedded in the formal knowledge sharing structures of scholarly publishing. Analysis of the outputs showed that most of these contributed to capacity-building uptake through direct (thesis production) or indirect (reading and citing) interactions. These interactions can be considered productive in that they led to further use of the research findings produced under the Botswana permits. The research capacity-building process does not stop when a thesis is finalized. Rather, its influence grows through indirect interactions far beyond the institutional, topical and geographic boundaries of the original work, functioning as a boundary object in a broad community of practice.

8.3.4 Objective 4: written acknowledgements as pointers to productive interactions

> …acknowledgements provide a more accurate description of intellectual networks, further eroding the myth of the lone scholar (Finnell, 2014, p. 1229)

The written acknowledgements of people and institutions who assisted researchers in production of their findings was explored through survey responses and the content of theses produced under research permit.

Acknowledgements sometimes point to productive interactions

Survey respondents who reported interactions with stakeholders in the field did not necessarily acknowledge these when they wrote up their findings. Field-based interactions with government officials were most reported as acknowledged (75%), with 43% of those who did *not* report interactions with government officials in the field indicating that they had acknowledged government officials in their written-up findings – likely referring to thanks for issuing of research permits before fieldwork began.

A small number those who reported interactions with community members in the field also reported that they acknowledged these in their written-up findings. This could seem to indicate that many of the interactions were casual, unintended encounters unlikely to be interpreted as productive interactions, but many comments made in response to this question referred to substantive, information-rich encounters, including working with community members as informants and employees.

Written acknowledgements in theses can form indicative records of interactions between researchers and potential users of the research, interactions that confirm local relevance, increased awareness, built trust, and increased understanding. While examination of written thesis acknowledgements did not readily reveal interactions that led to other interactions, thesis writers frequently made references to people or locations that either led to or enriched their investigations. Indicators of relevance of research to local conditions can be found in the gratitude expressed for Botswana-based support provided, through issuing of research permits by the Botswana government, and through funding and in-kind support. Interactions with a cross-section of stakeholders led to more awareness of the research in the broader community. Documented trust between researchers and others was often a product of working together, as was development of mutual understanding. The acknowledgements of thesis writers also revealed examples of the elements that make up a community of practice: mutual engagement, joint enterprise and shared repertoire.

8.3.5 Objective 5: research outputs as proxies for uptake through capacity-building

> While balancing the needs of academia with those of stakeholders is challenging, the benefits of enhancing local scientific capacity and generating more locally relevant research for improved conservation may be worth the risks …. (Duchelle et al., 2009, p. 578)

Development of the knowledge and skills of new researchers through formal education and training channels can be considered an important productive interaction as this results in further use of research. Results of the direction, supervision, and mentorship provided by senior researchers to graduate students through an intensive series of interactions may be found in the influence and spread of the new knowledge produced through theses and dissertations. This assumption was explored through the study described in Chapter 7. Some of the results follow here.

Capacity-building uptake continues conceptually and geographically beyond completion of a thesis

Eighty-nine percent of 200 research permits considered in this study contributed to capacity-building uptake through direct (thesis production) or indirect (reading and citing) interactions. These interactions can be considered productive in that they led to further use of the research findings produced under the Botswana permits. Their influence grows through indirect interactions far beyond the institutional, topical, and geographic boundaries of the original work, functioning as a boundary object in a broad community of practice.

Botswana-based research is contributing to capacity-building in the country, region, and continent

A significant proportion (43%) of the theses produced under the studied permits were written by students with home countries in sub-Saharan Africa, directly building knowledge and capacity of African researchers, and of those with whom they interacted throughout their research.

8.4 Some insights

My investigation was originally motivated by hearing the frequent complaint from members of the local private sector, government, and civil society that most wildlife researchers came for short periods from other countries with pre-defined research ideas, did not let local people know what they were doing, and neglected to share their findings in Botswana after their work was completed. This complaint was frequently coupled with one, often from researchers themselves, that it was difficult to find existing research about the region, and that research findings supplied to government 'gathered dust' on office shelves. It is worthwhile to examine the following indicative comments made in the context of interviews and discussions[30] carried out for this thesis research in the light of what the current research has revealed.

> *"Wildlife, wildlife is all we hear about. Why don't researchers care about people?"*
> **[Botswana citizen (G031)]**

The review of Botswana research in Chapter 2 indicates that, over the past 20 years, there has been a steady increase in social science studies looking at natural resource use in northern Botswana, and an increase in the number of conservation scientists who recognise conservation as a social issue and who are incorporating social issues in their ecological studies, particularly related to the human-wildlife conflict and illegal wildlife trade. This perception may be the result of a lag in awareness of current research or of continuing resentment of the international attention given to the conservation

[30] Comments captured in brief notes in the context of public meetings, events and some interviews, all collected under interview code G031.

of Botswana's wild animals. But also, Botswana citizens working in the safari tourism industry are well aware that most foreign visitors come to the country to see wildlife and not to interact with local people in settlements. Conservation scientists are influenced by the same socio-economic drivers.

> *"Where does all the research go? We see people coming from all over the world to study our animals, but they leave again and we never know what they have learned."* **[Botswana citizen (G031)]**

This study has shown that Botswana citizens are visible members of the northern Botswana research community of practice, in many cases participating as researchers themselves. While this study has also shown that there is a problem in local acquisition and curation of outputs of research carried out in Botswana, these outputs are increasingly available through online sources. While access is possible, however, awareness of the existence of studies is still poor, and non-academic stakeholders find it difficult to find outputs, even if they have access to online sources. Researchers still interact most with other researchers: more awareness would be created through their engagement with broader society.

> *"Researchers showed that fences were killing migrating wildlife. Now the fences are the only way to protect wildlife in the Delta."* **[Film-maker (G031)]**
>
> *"There are too many people studying carnivores, especially lions. What value are they adding if they keep repeating studies?"* **[Private sector manager (G031)]**
>
> *"We know that there are too many elephants. They are destroying most of the big trees: why don't the biologists admit it?"* **[Private sector manager (G031)]**
>
> *"Darting and collaring wild animals makes them aggressive. There is too much of it going on."* **[Private sector manager (G031)]**
>
> *"There is too much repetitive research: so many people somehow find reason to fit yet another collar on a lion makes the subject with lions and collars a bit ridiculous."* **[Private sector manager (G031)]**
>
> *"Retaliatory killings are on the rise, but nobody seems to be able to prove this."* **[NGO researcher (G031)]**
>
> *"She's been studying that for 11 years and we still don't see any results that can be used here."* **[Private sector manager (G031)]**

How researchers carry out their research, and present their findings, are framed by stakeholders using their own observations, experience, vested interests, and previous understanding of local conditions and acceptable interventions. Lags in theory adoption and absorptive capacity also influence stakeholder understanding. Dealing with these requires using them to communicate a clearer picture of what research is trying to achieve and explaining how much time, and how much uncertainty, is involved in producing reliable results.

> *"Research has shown that compensation doesn't work to protect wildlife, but the policy continues."* **[NGO researcher (G031)]**
>
> *"Now, looking back, I wish we had spent less time on research and more time down in Gaborone, buying drinks for Parliamentarians, because that is how you can really influence policy."* **[Private sector manager (G031)]**
>
> *"Poaching has increased enormously since the hunting ban went into effect, but getting evidence is difficult because of the illegal nature of the activity."* **[NGO researcher (G031)]**
>
> *"For the most part, there is no advocacy! I don't mean environmental education like you do in schools, but real advocacy where people get through to the policy makers."* **[Consultant (G031)]**
>
> *"What research gets done is largely determined by the interests of the donors."* **[Academic researcher (G031)]**

The results of this study indicate that most wildlife researchers in northern Botswana wish to have their findings understood and possibly adopted by the stewards of wildlife. Levels of frustration among researchers trying to achieve this are often high, but those who have consistently interacted with local stakeholders to include them in planning and fieldwork, and find opportunities to engage with policy processes, find themselves in a better position to influence those who make decisions. This takes time and effort, and benefits from longer-term engagement with the region.

> *"There is a real concern that research is done for the individual's benefit."* **[Government official (G031)]**
>
> *"Shouldn't researchers be compensated for their time if they present their research for the tourism industry?"* **[Consultant (G031)]**

Researchers who are interested in seeing their research used are constantly having to balance academic demands with those of stakeholders. It is natural and understandable for scientists to pay attention to the funding and institutional systems that support their work and provide their living. The academic research and reward system, however, is responsible for a great delay in making the new knowledge created by research visible and available: change of this system is needed.

8.5 Improving the future uptake of wildlife research in Botswana

The findings of this study reinforce the perception that, though research is recognised and valued by Botswana's wildlife stewards, it could offer more effective support to planning and management of this important resource. How can they ensure that research about the country's resources is best used? Is the Government of Botswana making the best use of independent researchers and Botswana-based NGOs as resources?

The most important lesson from this study is that efforts to increase the opportunities for productive interactions among stakeholders in northern Botswana's wildlife community of practice can be increased to ensure relevance, accessibility, trustworthiness, and understanding of research

produced. These efforts can be carried out by all major stakeholders. The following recommendations summarise comments received in interviews and discussions for this research.

Overall, Botswana's government would benefit from promoting and guiding engagement with research through building on its record of supporting inclusion of local communities in natural resources management research and monitoring and using its regulatory processes to further ensure early interactions with researchers. The government should actively encourage and support long-term research partnerships with independent researchers. It should also demonstrate consistency of interest in its partnerships with the private sector that provides a large economic contribution to the region.

Researchers should consider more engagement with stakeholders in priority setting, data collection, extended peer review, and knowledge translation, and lobby for changes in the academic process that does not recognise and reward productive interactions. They should pay more attention to government aspirations – including local employment – and political windows of opportunity. They should frame their research in terms of conservation objectives that are socially relevant. Perhaps most importantly, they should consider longer-term studies and research partnerships that enable building of local relationships. Scientists could do better in engaging with stakeholders, as they still rely significantly on their academic networks.

Research institutions and projects should provide incentives for stakeholder engagement and knowledge exchange by recognising productive interactions in performance assessment and allowing time and space for them in research project planning.

Botswana-based NGOs should build on their engagement with local communities and offer more value to government by building the capacity of local researchers to manage NGO activities, thereby opening more channels of interaction with Botswana policy-makers. International NGOs should include space and time for interactions in project planning: the global trends towards inclusivity and co-production in research are already there: they need to be recognised in the form of budgetary commitments.

Botswana's tourism industry could present accurate cost-benefit analysis of private sector involvement and support for research and monitoring activities so requirements for supplying information to government are not viewed as excessive.

8.5.1 Building more productive interactions into Botswana's research permit system

> *"When I started my degree, I went to DWNP, hoping for collaboration with them. They said, 'We hear you, but at the moment for us there are other issues that interest us.' What they were mainly focused on the time was predators and human-wildlife conflict – they*

> *would work with me if I could work on that topic. At the time [name of other researchers] were doing that. But I had already decided that I was looking at large mammal herbivores. They didn't see that to understand how predators behave, you need to know about the resource base – the animals they feed on. They were just responding to pressure – the human-wildlife conflict that had the government's attention. The department didn't have the capacity to conceptualise that as one basket."* **[Former academic researcher now working as a project manager (G028)]**

This investigation revealed existing and potential points of access for productive interactions that might facilitate greater sharing and use of wildlife research data in Botswana. The productive interactions approach, focused as it is on process, can be linked to managerial stages of research permit work, suggesting opportunities for interventions, including an increasing role for Botswana government officials as knowledge brokers.

In 2019, following its review of research permit processes, MENT issued a new set of guidelines for research. Table 8-2 indicates where the new guidelines appear to have addressed some of the issues identified as affecting productive interactions.

Table 8-2 MENT Guidelines relevant to productive interactions

Interaction	Guideline
Ensuring relevance through **joint priority setting** and project planning	**3.4** Alignment with Ministry research agenda, planning for impact pathways **6.4, 6.8** Inclusion of Botswana students, affiliation and collaboration with local tertiary institutions
Building trusted relationships through ongoing **knowledge exchange**	**3.4, 6.6** Participation of citizens **6.2** Submission of progress reports, legal deposit
Building capacity through **sharing the growing knowledge base**	**3.4** Access and benefit sharing **3.5** Informing affected communities
Committing to **long-term engagement**	**6.2, 6.9** Response to Ministry information requests, data sharing

While the guidelines do provide more opportunities for productive interactions and knowledge exchange, they emphasise action on the part of permit applicants and holders, and little on the responsibilities and capacity of government officials to participate fully in the interactive process. The effectiveness of the guidelines in facilitating more productive interactions will depend to a large extent on the ability of MENT to actively follow up with applicants and researchers issued permits. Table 8-3 points out some possible interactions, based on the findings of the survey reported in Chapter 5, as they fit into the permitting process.

Table 8-3 Possible interventions at stages of research permit process

Permit Stage	Type	Potential Interaction with	Possible Intervention
Application/Proposal submission	Indirect	MENT, line departments, review committee	Checklist of priorities, Specialist review
Request by researcher for local data	Indirect	MENT, Botswana research institutions, Other researchers	Brokerage of meetings/connections with local repository managers
Initiation of permit	Direct	MENT, Line departments	Meeting with DWNP, Checklist of potential interactions, Focal point identification
Recruitment/inclusion of local co-researchers, logistical support, and students	Direct, Indirect	Research institutions, NGOS, private sector partners	Brokerage; affiliation with Botswana universities to be promoted
Fieldwork	Direct, Indirect	MENT, NGOs	Encouragement and documentation of field visits, Regional MENT, NGO office visits, Outreach activities
Formal reporting	Indirect	MENT, Other stakeholders	Sharing of summaries, regularising feedback
Extension of work	Indirect, Direct	MENT, Other stakeholders	Incentives for longer term engagement
Dissemination	Indirect, Direct	MENT, Other stakeholders	Liaison with Botswana memory institutions, Support for specialised fora. Monitoring of research collaboration.

8.5.2 Addressing priorities for productive interactions

Some opportunities for using productive interactions to serve the needs of conservation science research uptake in Botswana are discussed in the following sections.

8.5.2.1 Priority-setting and project planning

The short-term nature of much conservation field research appears to be a barrier to productive interactions that might lead to better uptake of research. Research project funding takes time to

obtain, and once in hand, is accompanied by time limitations. The traditional organisation of academic calendars and scholarly publishing also contributes to the time pressures experienced by researchers. But scholars of research uptake tend to agree that joint priority setting and planning of research with stakeholders from the beginning are powerful interactions that usually lead to better uptake, as this ensures that the research will be relevant to its potential users (Braunisch et al., 2012; Gordon et al., 2014; Neff, 2011; Nguyen et al., 2015; Sutherland et al., 2011).

It is assumed that most foreign researchers exercise due bibliographic diligence to understand local conditions in Botswana and the current state of knowledge for their topic, before submitting a proposal for a permit – almost half of survey responses indicated that background reading influenced the principal investigator's choice of research topic. Nevertheless, MENT's research permit process could include more early-stage interactions to encourage research permit applicants to engage with existing guidelines, research outputs, and current ongoing conservation work in the country, to help shape their research plans and methods.

8.5.2.2 Knowledge exchange

The process of collecting, processing and analysing data collected in the field offers multiple opportunities for productive interactions among wildlife researchers and stakeholders. Just over half of all respondents to the research permit survey indicated that they used data from other sources to support their work. Sixty-eight percent of these reported a Botswana government source for the data used; 52% responded that they used data from other independent researchers, and 8% used data from an NGO source. Joint data collection across stakeholder groups can lead to better understanding of the context needed to make data more interoperable and re-useable (Edwards et al., 2011). Examples of such collaborative work already taking place are the aerial census work carried out jointly by the DWNP and Botswana NGO Elephants without Borders (Chase, 2011), the inclusion of community escort guides in Round River's training of students in monitoring techniques (Round River Conservation Studies, 2018), and the joint DWNP-NGO CKGR spoor survey (Maude, 2012). MENT could broker and support more such arrangements as part of the permitting process, including assignment of its own staff members to data collection work of independent research projects.

> *"Collaborating and pooling data to get the bigger picture for large carnivores in Botswana made it possible to get decent coverage for large parts of Botswana."*
> **[Professional in private sector and student at South African university]**

Feedback, through questions, comments, and conversations is a powerful mechanism for adding value to research when it is underway. The existing MENT research permit process requires quarterly progress reports from researchers in the field. The survey found that, overall, researchers

reported about 50% compliance in providing these reports. Perhaps more significantly, 73% also reported that they did not receive any comments, feedback or direction from DWNP officials while they were in the field, and 83% did not receive comments or feedback from DWNP about their final results. It is possible that better feedback can lead to better compliance in reporting, adding value and leading to more uptake of research.

8.5.2.3 Contribution to the knowledge base and capacity

While stimulating conversations and discussion of work at the point of problem may appear to characterise productive interactions within a community of practice, their influence can be multiplied through deliberate contributions to the capture and preservation of codified knowledge, to structured capacity building, and institutionalisation in the form of long-term partnerships.

8.5.2.3.1 Support for memory institutions

> *"Knowledge is not well looked after, even data. The discipline of information management doesn't belong to the traditional disciplines we are familiar with. It is subsumed in other areas. In the minds of policy-makers, it is not important. The EIS [Botswana Environmental Information System] was a lesser priority, not carried out at levels where people can claim a stake."* **[Former academic researcher now working as a project manager (G028)]**

Memory institutions – institutional repositories, libraries, archives, and museums – offer long-term preservation and access for research reports and other materials in a world where the steady loss of online content is of increasing concern (Duda & Camp, 2008; Jones et al., 2016; Sellitto, 2005). Online repositories, such as the Botswana Government's Environmental Information System developed to meet the clearing-house mechanism requirement of the National Biodiversity Strategy and Action Plan (Botswana Dept. of Environmental Affairs, 2016), are often difficult to maintain. Redundancy – ensuring multiple locations of documents – has been identified as a mitigating strategy. Overall, 30% of respondents to this survey reported that they had shared the final analysed results of their research with memory institutions – usually indirectly by sending a copy to the institution. A 2014 study of deposits to the University of Botswana's Library Botswana special BDSC collection found approximately only 29% of outputs created from a five-year selection of MENT research permit work issued were received by the library and catalogued (Morrison 2014, 21), even though a follow-up process was in place in the library. Support, through government partnerships, for legal deposit processes already defined by the permit process could lead to better overall dissemination and understanding of uptake, as these documents, apart from providing local access to research findings, are a valuable source of information about productive interactions.

8.5.2.3.2 Training and capacity-building

Many productive interactions are the result of social learning, when stakeholders learn from one another other and create new knowledge while building trust (Church et al., 2002; Shackleton et al., 2009; Sterling et al., 2017) In addition to providing an opportunity for graduate students to carry out thesis research, research fieldwork can include both formal and informal learning through engagement with stakeholders. Transfer of scarce skills in the areas of GPS, GIS, remote sensing, vegetation, coding, and animal survey methodology, is effective at the point of problem in the field, while the sharing of local and indigenous knowledge by trackers and guides takes place in living context. Between three and nine percent of research permit survey respondents reported formal training activities as interactions between their project and one or more of the DWNP, community members, other researchers, and NGOs. More of these could be encouraged.

8.5.2.3.3 Long-term engagement

Arguments for commitment to long-term research to support conservation science are many and convincing (Durant, Bashir, Maddox, & Laurenson, 2007; Gingrich et al., 2016; Lindenmayer & Likens, 2009; Magurran et al., 2010; Willis et al., 2007). Findings from the survey of MENT research permits indicate that researchers who may have come to Botswana to carry out a single study, often as part of a graduate programme, and return to carry out follow-up studies, add more value as their engagement with local stakeholders, and their understanding and knowledge, grow. Their experience and commitment can be considered assets for Botswana. While it would not be possible for all foreign researchers to invest long-term in the country, MENT could consider building incentives for this type of continued work into the research permit system.

Communicating this preference for longer term studies to potential researchers, foreign research partners, and funders might also stimulate change in the global academic systems that demand quick turnaround, especially in graduate student work.

8.5.2.3.2 Cost implications

Increased levels of interaction with stakeholders will normally, for researchers, increase the costs of carrying out research, and for regulatory bodies, operating costs. This can be painful for both, especially when trying to calculate the number of radio collars, quantity of aviation fuel or laboratory chemicals that can be met by a budget, or when deploying officials who are already thin on the ground. Monitoring and documenting productive interactions can assist in determining the return on investment for these efforts, including the potential for reduced costs of implementing research recommendations (Reed, 2006; Sterling et al., 2017).

> *"It is not cheap to use local students and assistants on projects, because they have to be paid. This has to be written into project budgets. Donors like to see that local people are being trained. If students are from Botswana, they also care more. All our Batswana students have been able to get jobs."* **[NGO researcher (RP018)]**

Maintaining government permit and licence fees at levels that do not discourage research is likely to be easier if productive interactions are exposing the benefits of knowledge exchange in the form of increased capacity and useable scientific findings.

8.5.3 Recommendations for short-term researchers

The structure of academic graduate programmes means that not all foreign researchers who wish to carry out their fieldwork in northern Botswana can commit to long-term engagement with the region and its people, and the benefits that accompany opportunities for multiple productive interactions with stakeholders. While short-term researchers are at risk of low uptake of their work, there are, however, actions that will support them. Productive interactions can be planned. Usually, these will require more investment of time and resources than might have been anticipated, so need consideration when requesting funding support and allocation of research period. Some of these are outlined in MENT's research permit guidelines, but the following table of proposed interactions is indicative:

Table 8-4 Recommendations for short-term researchers

Research Stage	Recommendation
Planning Stage	Develop a collaborative relationship with a Botswana-based research institution that includes planning for joint activity, preferably with a local student
	If a natural science investigation, investigate organisations that support social development for possible funding of community engagement activities
	Include Botswana Government and local NGO reports in preliminary literature review when selecting a research topic
	Consult and make specific reference to priorities identified in the latest Botswana Government research strategy
	If working on a natural science topic, learn about the geography and people of the region where the fieldwork is to be done
	Include in the proposal a data management plan that indicates how data collected will be made available to support further research in Botswana
Fieldwork Stage	On arrival in the country, make in-person visits to Botswana Government offices at both Headquarters and the region of work, and to the contacted research institution, and ask to make a presentation about the planned research

Research Stage	Recommendation
	Keep regional government officials informed of progress and interim results throughout the fieldwork with personal visits at least at the beginning and end of the fieldwork period
	Make a personal visit to the local community leadership to explain the work: offer to make a presentation, and listen to comments
	Keep a reflective field diary where all interactions and the insights they provide are recorded
	Submit required reports on time, and include questions to receiving officials so they will associate an action with the report content
	Participate in any relevant local, regional or national events by making presentations or sharing experience
Follow-up Stages	When writing up the results, include acknowledgment of local interactions and support
	Create plain-language, local language, and management summaries of the work and share with all Botswana contacts, including local news media. Consider sharing findings in accessible media such as short video.
	Ensure that final document(s) are submitted to both the government agency that issued the permit and to national library and archive bodies
	Send links to documents deposited in online repositories to Botswana contacts
	Follow up on data management commitments
	Offer to mentor other researchers who are planning work in Botswana

8.6 Contributions to the theory of research uptake

This work can contribute to more understanding of the fields of research uptake and knowledge exchange research in the context of conservation science.

The research undertaken for this thesis was novel in that it carried out a close examination of regulatory records in the context of interactions between researchers and stakeholders, analysis of the content of scholarly acknowledgements to shed light on productive interactions, and tracking of the expansion of the capacity-building influence of theses and dissertations through a bibliographic study.

In addition, my investigation served to validate findings and theoretical approaches used in the study of research uptake. These included scholarly expansions of CRELE approach originated by Cash et al. (2002)Wenger's Community of Practice theory (1999), and the productive interactions approach of Spaapen and Van Drooge (2011). The investigation of the *Research Talks for Everyone* event also allowed combination of the theories of Lehr et al.(2007) and Tindal (2016) that apply to evaluating the role of events in stimulating research uptake.

8.6.1 Credibility, Relevance and Legitimacy (CRELE)

The conditions necessary for uptake of research have been well explored by scholars, including by those in conservation science, and many of these have applied and modified Cash et al.'s original classification of CRELE (Dunn & Laing, 2017; Durham E, Baker, Smith, Moore, & Morgan, 2014; Kowalczewska & Behagel, 2018; Rodela, Reinecke, Bregt, Kilham, & Lapeyre, 2015; Sarkki et al., 2015). Working though these discussions, my approach was to take up the suggestions of some and, drawing from the field research, reformulate these conditions as these as Awareness, Relevance, Trust, and Understanding, using these throughout my analysis of findings. Use of these categories was supported by the two theoretical frameworks used in this thesis work, Communities of Practice and Productive Interactions.

8.6.2 Communities of Practice

The increasing relevance of Wenger's Community of Practice theory, as recognition of the importance of social learning and human networks in the uptake of conservation science research grows, is validated by this study. Focusing on a small community with a common vested interest – the preservation of wildlife – was suited to this approach as Wenger (2011) pointed out that communities of practice naturally create boundaries that define their membership, and "… because of the unavoidability of boundaries, there is an inherent locality to engagement and to practice" (Wenger, 2011, p. 4). Both the research permits and the outreach event studies made this clear, but the bibliographic analysis in Chapter 7 showed how a community of practice could influence other, very remote communities, forming overlapping learning and potentially common 'landscapes' of practice.

This recognition is perhaps most useful in the local context of organisations working on improving the science-policy interface (Bonyongo, 2016) to create more relevant and useable research, suggesting the value of developing an understanding of the social workings of these communities.

8.6.3 Productive interactions

> Long, busy and discontinuous pathways. (Earl, Carden, & Smutylo, 2001, p. 6)
>
> An … iterative process of interaction between scientific and other social domains and stakeholders. (Akker & Spaapen, 2017, p. 17)

The strength of the productive interactions approach, somewhat like that of Community of Practice, is in its underlying fundamental simplicity. This quality also presents a challenge to systematising its application. One can ask, *What are the characteristics of productive interactions? What are the barriers? What facilitates them? And, if they are to be considered indicators of research uptake,*

how can they be described and measured? The work for this thesis offers some responses to these questions.

The argument that the conditions needed for research uptake – awareness, relevance, trust and understanding – are most positively affected by continual engagement of researchers with potential users throughout the life cycle of the research process is easy to understand and, in most cases, to accept. The research for this thesis has demonstrated that productive interactions are characterised by exchanges of knowledge that create these conditions.

The processes that are intended to ensure quality in scholarship can be barriers to productive interactions and to communication of research processes and findings to audiences broader than academia. But researchers' preferences, based on their character and choice of discipline, are also a factor. Conservation science is an example of this. Its specialists are often focused on esoteric studies of rare species and their relationship to very specific environments. They are drawn to work in nature and the field or in the laboratory – away from other people. The language of biology is sophisticated and difficult, and it is difficult to relate findings at the micro scale to their possible impact on society.

Conservation science goes some distance in bridging the gap between the worlds of wildlife biology and human society, since it has an interventionist purpose, but its practitioners usually come from a background in biology and continue with a strong attachment to their scientific training and to their species specialisations. An example of this in the northern Botswana community of practice is the formation of local specialist groups for the study of carnivores and herbivores.

An interesting line of investigation is that examining what leads to 'Open research behaviours': a willingness or affinity of researchers to engage with potential users at all stages of research (Benneworth & Peñuela, 2019). Recent findings seem to indicate that an essential motivator for researchers to engage was learning that others thought their research potentially useful. This was observed in the interactions resulting from the *Research Talks for Everyone* event, which also showed that rather than focusing on attribution of piece of research to specific impact, a focus on contributions that are made throughout a progressive process of gradual engagement, uptake, reengagement, and use makes more sense. This supports the productive interactions argument for early engagement with a broader audience.

The SIAMPI project that built arguments for the use of the productive interactions approach described the following conditions that have been validated by the current study:

- A variety of channels of interaction: NGOs and projects can function as useful catalysts for larger scale productive interactions

- Adaptation to stakeholder needs: one-to-one, personal cooperation and support have been observed to be important
- New, unplanned interactions evolving: 'sheltered' and 'sandbox' safe spaces for sub-communities are needed for getting consensus before broader interactions are possible
- Overlapping stakeholder boundaries: crossing of professional sector boundaries leads to more openness
- Broadening of the social reach of the research: transdisciplinary and cross sectoral research has large potential but requires clear incentives and more time.

Fieldwork for this study has revealed some characteristics of productive interactions among northern Botswana wildlife stakeholders. There is potential to increase productive interactions among wildlife researchers and stakeholders in northern Botswana: this is addressed in Section 8.4 of this chapter. It is also useful to look at how existing interactions – of which there appear to be many – can be better captured to feed into analysis of the most effective pathways to impact. Evidence of productive interactions can be collected throughout and after the research process in many ways, through project recordkeeping to analysis of thesis acknowledgements, as was carried out in Chapter 7 of this thesis. It has never been easier to document processes: tools abound.

It is clear that in most scientific disciplines, including in conservation science, there is a trend towards research that looks to societal relevance, and discusses the need to work in a transdisciplinary way to include the knowledge of stakeholders in the research process. While natural scientists in general may be slow to recognise this global trend, conservation scientists who work in the field next to local people who live close to wild animals can no longer avoid the need for interaction and exchange of knowledge beyond their scientist colleagues. A manager for a Botswana NGO that studies elephants explained:

> *"Working with people on the ground in the communities helps us understand the complex cultural and social systems that affect conservation. [Name of NGO] has a very good community officer [name of officer]. He has returned to the area to farm after working away for some years, so he understands both worlds."* **[NGO manager (G016)]**

And, from an academic researcher:

> *"Governments are slow to move. The bigger impact is when you go directly to the end users. Like we did with the fishing disputes resolution for the [name of project]. But you have to make government your partner; otherwise the end users will not trust your recommendations. It gains legitimacy. As a fisheries biologist, I have always worked closely with fisheries officials. It is also important to make the stakeholders a part of the process as early as possible."* **[Academic researcher (G009)]**

This trend means that there will be an increase in opportunities to observe interactions of researchers and other stakeholders in research projects and outreach practice, and to develop methods that facilitate productive interactions.

8.7 Limitations and pathways for future research

> …a journey down a long and winding road towards capacity development for better research uptake. (Mendizabal & Datta, 2011, p. 11)

8.7.1 Limitations of the study

Some limitations of the current study should be noted.

The most important limitation of the study is that the findings are disproportionately based on the experience and perceptions of researchers, with relatively little input from Botswana's key wildlife steward, the Department of Wildlife and National Parks, and other government bodies. Part of the reason for this is that government officials are 'thin on the ground' and part is because, in their role as public officials, it is likely that they do not wish to go on record to say something for which they might be held accountable by their organisation. Chapter 4 also points out the difficulty of getting government officials to participate in events outside of their normal working hours. The problem of capturing the point of view of government stakeholders is partly mitigated by the frequent movement of personnel across sectoral boundaries: today's junior government official becomes tomorrow's graduate student, and the next day's INGO programme manager, perhaps then moving on to an academic role in one of the country's tertiary institutions. The surveys and interviews carried out for this study did capture the experience and opinions of these boundary crossers, but the work would have been improved if frank conversations with people in the current role of public servants had been possible more often.

The methodology for this study, as pointed out in Chapter 4, evolved, incorporating a type of ethnographic participant observation that had not been clearly identified at the planning stage of the work. It is possible that a clearly stated action research agenda would have resulted in a different, perhaps stronger, set of useful findings about productive interactions.

While the research permits survey had a good response rate, some important researchers refused to participate as they felt that the study was 'not scientific enough'. These researchers – mainly biologists and mainly living outside Botswana – had enjoyed the benefits of many years of research in the country but did not see the value of sharing their experience for the purpose of improving the uptake of research. It is possible that they would have responded more positively if the researcher had been a natural scientist, but it could be argued that their response demonstrated the very nature of the problems addressed in this thesis.

The research permit survey did not include an important question about the training of graduate students as capacity building. When carrying out the analysis for Chapter 7 that traced the influence

of thesis and dissertations, I recognised that the answers to this question would have enriched the findings of the bibliographic work.

The work would have benefitted from more analysis of the policy documents and consultants' reports developed by, or on behalf of, the Government of Botswana to determine links between their content and research carried out in the country. Access to many of these documents was not available.

For the *Research Talks* study, the size of the sample was necessarily limited by the number of attendees. Follow-up interviews that revealed more in-depth thinking and detailed experience from event attendees were limited because of time constraints.

It would have been useful to interview people, especially from the professional academic research community, who knew about the *Research Talks* event but never attended, to compare their knowledge of, and engagement with, the research presented.

Finally, the work carried out to determine uptake in the form of capacity-building resulted in information about types of documents other than scholarly publications influenced by the Botswana research outputs studied. These included reports that are closely related to the application of research. Study of these would have added weight to this thesis's claim that indirect interactions were productive in leading to use through next steps.

8.7.2 Pathways for future research

The work for this thesis has created many questions that were not possible to answer in the study period.

As just one of many possible settings for productive interactions related to research, and recognising the 'soft' and difficult-to-measure nature of much of the uptake generated by public outreach events, is it worth investing more effort to learn more about them? It could be argued that, as accessible, easily observed, and relatively successful knowledge sharing mechanisms, examining the conditions that make this type of activity effective could inform development of other platforms for productive interactions.

Previous studies of events similar to the *Research Talks for Everyone* have called for more study of the barriers to free and multi-directional exchange that indicate a levelling of the knowledge playing field. The findings of this study indicate that there appear to be few of these barriers in this particular setting, but this may differ in larger communities with more formal arrangements, and where many people do not know one another. Application of psychological analysis to the conditions that facilitate full participation, including developing typologies of character and

personality of participants such as those put forward by Peñuela et al. might be useful in such settings (Peñuela, Benneworth, & Castro-Martínez, 2014).

Other studies have pointed out the need for more detailed examination of the wider social and political environment in which interactions related to these events are occurring, and the networks that feed the events. Social network analysis of speakers and audience members could reveal interesting patterns of interaction and combined with evidence of collaboration from publications.

Scholars have also called for ethnographic investigation of public outreach events to determine the conditions that are conducive to productive interactions. Suggestions made by survey respondents for improvements to the Talks addressed the issues of audiences, capacity building for presenters, follow-up by organisers, formality, format, presentation length and formats, scheduling, time management, and venue. Changes to any of these could be used in an experimental way to test whether changing formats, venue, or presentation the changes would affect the level and type of interactions taking place.

Follow-up of the replication and use of the published summaries in online sources might reveal more about the uptake of the research originally presented at the *Research Talks*. Comparison with other types of knowledge sharing events, in particular the workshop, is worthy of a study on its own, given the importance of this multi-stakeholder platform in Botswana (Morrison, 2014) (RT012).

Finally, the challenge of engagement with government managers and officials who represent the stewardship of wildlife resources could be addressed though an examination of motivation and reward systems in Botswana government research agencies.

One potentially interesting avenue of investigation would be to look at the role of memory in productive interactions. Accounts of interactions that are not documented at the time of the interaction depend on personal memory. If an interaction is memorable, can it be considered productive? Memorable interactions must imply that there is a meaningful connection: that new knowledge attached itself to something the recipient already knew or understood. This has implications for communications work: dissemination efforts must speak to the experience or needs of the recipient.

If productive interactions are to be considered important enough as indicators for evaluation of research quality, there need to be practical systems for capturing and documenting the activities that resulted in them. Birge Wolf and others have begun to look at this challenge (Wolf, Szerencsits, Gaus, Müller, & Heß, 2014). Studies that use archival sources to examine the value of

correspondence and other exchanges between researchers and stakeholders, such as that by Boshoff and Sefatsa, can also show the way (Boshoff & Sefatsa, 2019).

The field of political ecology offers opportunities to students of research uptake and the science-policy interface in the form of frameworks and language (Bixler, 2013; Hongslo, 2015; Lawton & Rudd, 2014; Robbins, 2006). Botswana's wildlife conservation issues such as the viability of Community Based Natural Resource Management (CBNRM), commercial hunting, and safari tourism are contested grounds that could benefit from transdisciplinary work on what is meant by science-based management.

Lack of access to an important government repository prevented my study from evaluating links between scientific research and Botswana policy documents using alternative bibliometrics. This access would have enabled a better assessment of influence of research findings at the 'next-user' level (McLellan, 2020, p. 5) and allowed investigation of the interactions that led to commonalities in the two types of information. If Botswana's Environmental Information System (EIS) is revived, it could be used for this purpose. The Google Scholar capacity-building investigation described in Chapter 7 of this thesis, which showed that grey literature such as reports had used research findings from Botswana scholarly publications, could be similarly followed up.

The role of non-governmental organisations in Botswana's wildlife research community of practice should be studied in more detail, as the observations of the current study have indicated a boundary role that deserves further investigation. Especially interesting would be a comparison of the effectiveness in influencing policy and practice of locally 'owned' and politically connected organisations such as the Kalahari Conservation Society and Birdlife Botswana with that of NGOs established by foreigners, perhaps testing the useful checklists for evaluating effective conservation partnerships of Margoluis et al. (Margoluis, Margoluis, Brandon, & Salafsky, 2000).

Finally, the on-going efforts to engage Botswana's private sector safari tourism businesses in monitoring environmental conditions in concession areas need to be followed, as there could be much to be learnt from them about public-private partnerships in research.

8.8 Conclusion

This research set out to determine whether research carried out in or about northern Botswana has been focused on producing useful and used work in the area of wildlife and related natural resources, with a view to improving management of these resources. The thesis works towards this objective by investigating how uptake and use of wildlife research findings in the region may be affected by productive interactions of researchers and potential users of research in a localised community of practice.

Three case studies analysed the outcomes of literature review, surveys, interviews, and document analysis to reveal patterns of interaction positively related to perceptions of uptake among researchers and wildlife research stakeholders. The thesis finds that conditions that support research uptake – awareness, relevance, trust, and understanding – are created through a range of planned and unplanned, direct and indirect, productive interactions between researchers and potential users of the research.

This research identified interactions among researchers and stakeholders that led to uptake and use, and explored factors that appear to support research uptake: early engagement of researchers and research stakeholders to ensure local relevance and awareness, ongoing exchange of data and knowledge to improve trust, long-term investment in a research location and its stakeholders, use of knowledge-sharing outreach platforms to increase understanding, and capacity building through involvement in research.

The work was able to describe a northern Botswana wildlife research community of practice made up of stakeholders from academia, local communities, the tourism private sector, management consultancies, and NGOs – a localised social system characterised by mutual engagement, joint enterprise, and shared repertoire. Knowledge exchange within this community of practice takes place through planned and unplanned interactions, many of which can be described as productive and leading to uptake and use. Scholarly outputs from research carried out in this community result in development of more research capacity in Botswana, the region and across the globe.

The research has shown that the interactions needed to nourish uptake of wildlife research in Botswana can be encouraged and supported through a combination of effort by all stakeholders. Based on these findings, the thesis recommends actions that could improve the uptake of northern Botswana wildlife research in the form of application to practice and capacity-building.

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Appendices

1 Questions for Research Permit survey

2 Questions for *Research Talks for Everyone* survey

3 List of presentations made at *Research Talks for Everyone*, September 2015 to October 2017

4 List of events attended related to the thesis work

5 Ethics clearance certificates

6 Sample semi-structured interview guide

Appendix 1 Questions for Research Permit survey

Botswana Research Permit Followup

Introduction

Thank you for responding to this survey.

My name is Monica Morrison a student at the Centre for Research on Evaluation, Science and Technology (CREST), Stellenbosch Universrity and I would like to invite you to take part in a survey, the results of which will contribute to a research project in order to complete my PhD.

Please take some time to read the information presented here, which will explain the details of this project.

Your participation is entirely voluntary and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part. I am looking at outputs from research permits issued by the Botswana Department of Wildlife and National Parks (DWNP) between 1996 and 2014. This is to see whether the findings from this research have been put into use, especially in Botswana.

I am contacting you because you were issued a research permit by the DWNP during this period. The questions in this brief survey are intended to provide some context for analysis of the outputs, asking, for example, about communications researchers had with wildlife managers and other stakeholders in planning, fieldwork activities, and finalisation of results.

Your responses to this survey will be anonymised in the process of analysis. Please feel free to contact me by email at monicamorrison@gmail.com or telephone at +267 71757223 if you have questions about this work, or would like to share more of your experience.
My supervisor is Dr Nelius Boshoff at scb@sun.ac.za.

The survey will take approximately 15 minutes to complete.

RIGHTS OF RESEARCH PARTICIPANTS:

You have the right to decline answering any questions and you can exit the survey at any time without giving a reason. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research participant, contact Mrs Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

Thanks again!

Monica Morrison

* 1. I confirm that I have read and understood the information provided for the current study.

- ◯ Yes
- ◯ No

* 2. I agree to take part in this survey.

- ◯ Yes
- ◯ No

Botswana Research Permit Followup

* 3. What was the topic of your research, and its geographic extent?

Botswana Research Permit Followup

Planning of Research

Who was involved in selection and planning of research

4. What made you choose your research topic?

- ☐ suggestion by research supervisor
- ☐ background reading about species or issue
- ☐ discussion with colleagues already working on the topic
- ☐ request by NGO or private sector sponsor
- ☐ commissioned research specified the topic
- ☐ Other (please specify)

5. What made you decide to carry out your research in Botswana?

- [ ] research supervisor
- [ ] unique conditions
- [ ] colleagues already working there
- [ ] request by NGO or private sector sponsor
- [ ] commissioned research specified the country
- [ ] Other (please specify)

Botswana Research Permit Followup

Fieldwork

xxxxxx

6. After receiving your research permit, and while you were in the field, did you have interactions about your research with any of the following?

- [ ] DWNP or other government officials
- [ ] people living in your research region
- [ ] local Batswana researchers
- [ ] researchers from outside Botswana
- [ ] NGO or private sector sponsor

Please describe the nature of any interaction

7. Who was instrumental in the success of your fieldwork?

- ◯ DWNP officials
- ◯ supervisor
- ◯ local community members
- ◯ other researchers
- ◯ NGO or private sector sponsor
- ◯ Other (please specify)

8. Did you complete regular reports to the DWNP during your fieldwork?

- ◯ Yes
- ◯ No

Explanation

9. Did you receive comments, feedback or direction on your research from DWNP or other government officials during your fieldwork?

- ◯ Yes
- ◯ No

Comment

Botswana Research Permit Followup

Use of Data

How the research data was handled

10. Did you use data collected by others as part of the your research in Botswana? If yes, please indicate source and type of data.

- ◯ Yes
- ◯ No

Source and type of data

11. Apart from any analysed outputs, have you shared the data collected during your fieldwork with any of the following?

- [ ] Government of Botswana
- [ ] other researchers
- [ ] in a public repository
- [ ] in a restricted repository
- [ ] with NGO or private sector
- [ ] Other (please specify)

12. If you shared your data with others, what was the trigger?

- [ ] a direct request
- [ ] institutional policy that governed your research
- [ ] personal preference
- [ ] Other (please specify)

13. To your knowledge, have the data you collected during your Botswana fieldwork been reused by others? If yes, please describe.

- ◯ Yes
- ◯ No

Please describe

Botswana Research Permit Followup

14. When writing up your research, did you use and cite Botswana government documents?

- ◯ Yes
- ◯ No
- ◯ Comment

15. When writing up your research, did you include local researchers, guides, translators, or other helpers in your acknowledgements?

- ◯ Yes
- ◯ No
- ◯ Comment

Botswana Research Permit Followup

Sharing of Results

How research results were shared

16. On completion of your fieldwork, did you share your results with any of the following in Botswana?

- ◯ Botswana research institutions
- ◯ DWNP
- ◯ NGO or private sector sponsors
- ◯ other researchers
- ◯ Other (please specify)

17. Did you use any of the following methods to share your results with people and organisations in Botswana?

- ◯ Copy of article or thesis
- ◯ Management or lay summary of findings
- ◯ Custom scrapbook
- ◯ Live presentation
- ◯ Other (please specify)
- ◯ Recorded presentation
- ◯ Video or film
- ◯ Podcast
- ◯ Workshop

18. Did you receive comments, feedback or direction on your research from DWNP or other government officials after sharing your findings?

- ◯ Yes
- ◯ No

19. Do you have evidence that your research has been relevant to practical management or policy development at any of the following levels?

	Subtantial	Some	None
local community	☐	☐	☐
national	☐	☐	☐
regional	☐	☐	☐
global	☐	☐	☐

20. Did you share or disseminate your research in any of the following formats?

- ☐ articles in popular magazines
- ☐ follow-on collaborative work
- ☐ online discussion groups
- ☐ presentations at schools or to general audiences
- ☐ presentations at workshops
- ☐ presentations to local communities
- ☐ social media: e.g. blogs, Twitter, Facebook, LinkedIn, Kudos
- ☐ stories in news media
- ☐ submission of outputs to open access repository (Adademia.edu, ResearchGate, institutional repository (including Government of Botswana)
- ☐ formal submissions to government commissions or committees external to the department that issued the research permit
- ☐ online discussion groups
- ☐ Other (please specify)

21. Looking back at the entire cycle of your research activity in Botswana - from planning to dissemination, what do you think was:

the most effective channel of dissemination?

the research's most significant use

22. If you have a list of your research outputs, including publications that resulted from your research in Botswana, would you please share it as a link or attachment to email at monicamorrison@gmail.com.

Appendix 2 Questions for *Research Talks for Everyone* survey

Research Talks for Everyone Followup

Followup to ORI-Kwando Research Talks for Everyone

Can the methods and tools scientists use to share the results of their work with other scientists can be transformed to make the research results easier for non-scientists to understand, and use, in their policies and work?

The *Research Talks for Everyone* series organised by the University of Botswana's Okavango Research Institute, supported by Kwando Safaris, is an example of how it's possible to get people more engaged in using research results to support conservation and effective management of natural resources.

My name is Monica Morrison, a student at the Centre for Research on Evaluation, Science and Technology (CREST), Stellenbosch University and I would like to invite you to take part in a brief survey, the results of which will contribute to a research project in order to complete my PhD.

Please take some time to read the information presented here, which will explain the details of this project.

Your participation is entirely voluntary and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

I am contacting you because you attended more than one *Research Talks for Everyone* event. The questions in this brief survey are intended to shed light on whether the Talks provide productive interactions for the uptake of research.

Your responses to this survey will be anonymised in the process of analysis. Please feel free to contact me, Monica Morrison by email at monicamorrison@gmail.com, or telephone at +267 71757223 if you have questions about this work, or would like to share more of your experience.

My supervisor is Dr Nelius Boshoff at scb@sun.ac.za.

The survey will take approximately 5 minutes to complete.
Results of the survey will be shared with the organisers of *Research Talks for Everyone*.

RIGHTS OF RESEARCH PARTICIPANTS:

You have the right to decline answering any questions and you can exit the survey at any time without giving a reason. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research participant, contact Mrs Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

1

Many thanks for your support of the Talks, and of this research.

* 1. I confirm that I have read and understood the information provided for the current study.

- ◯ Yes
- ◯ No

* 2. I agree to take part in this survey.

- ◯ Yes
- ◯ No

Research Talks for Everyone Followup

3. How did you find out about the Research Talks?

- ◯ Facebook
- ◯ Email
- ◯ Word of Mouth
- ◯ Other

Comment

4. What was your initial motivation in attending?

- ☐ General interest in what is happening in the local community
- ☐ To accompany a friend or colleague
- ☐ Research related to my work
- ☐ Support to a specific speaker
- ☐ Other

Comment

5. Did anything limit your attendance?

- [ ] Time of day
- [ ] Distance from home or work
- [ ] Lack of interesting or relevant topic
- [ ] Conflicting events or travel
- [ ] Other

Comment

6. Has exposure to presentations at the event affected:

- ◯ How you think about an issue?
- ◯ How you carry out your work?
- ◯ How you interact with people in the community?

Comment

7. Has exposure to discussions at the event affected:

- ◯ How you think about an issue?
- ◯ How you carry out your work?
- ◯ How you interact with people in the community?

Comment

8. Have you later shared what you learned at any of the Talks with others?

- ◯ Yes
- ◯ No

If yes, can you give some details?

9. Have you used anything you learned at the Talks in your work?

- ◯ Yes
- ◯ No

If yes, can you give some details?

10. Have you ever personally followed up with a presenter after the Research Talk event? If yes, would you describe the action?

- ◯ Yes
- ◯ No

If yes, can you give some details?

11. Do you use the summaries of talks that are sent out after the event?

- ◯ Yes
- ◯ No

If yes, how do you use them?

12. Can you suggest improvements to the Research Talks for Everyone events?

13. Would you be willing to participate in an interview to discuss the Research Talks further?

- ◯ Yes
- ◯ No

If yes, please enter your name and telephone number here.

Appendix 3 List of presentations made at *Research Talks for Everyone*, September 2015 to October 2017

Date	Title	Presenter	Organisation	Speaker Affiliation	Status
2015/09/21	Social ecology and human conflict mitigation of male elephants in the Boteti River region	Isden, Jess	Elephants for Africa	NGO	Employee
2015/09/21	Dynamics of human-lion interactions in the Makgadikgadi Pans National Park, Botswana	Ngagka, Keitumetse	Okavango Research Institute	Academic	Grad Student
2015/09/21	Experiences of pregnancy and childbirth among women in the remote areas of the Ghanzi District	Albers, Anna Lisa	Okavango Research Institute	Grad Student	Grad Student
2015/10/25	Community knowledge and understanding of how defilement is addressed through common and customary law: a case study in the North West District	Gabalape, Taujele	Women Against Rape	NGO	Employee
2015/10/25	Plants of Northern Botswana	Heath, Roger and Alison	PlantsandpeopleAfrica	NGO	Employee
2015/10/25	How satellite-derived data have improved our understanding of the Okavango-Magkadigkadi zebra migration	Bartlam-Brooks, Hattie	Botswana Herbivore Research	NGO-Consultant	Employee
2015/11/23	Habitat selection by Cape buffalo (*Syncerus caffer caffer*) in relation to changing water availability	Bennitt, Emily	Okavango Research Institute	Academic	Employee
2015/11/23	Spatio-temporal distribution of large carnivore preferred wild prey in northern Botswana,	Rutina, Lucas	Okavango Research Institute	Academic	Employee
2015/11/23	Using livestock guarding dogs to mitigate human-carnivore conflict	Horgan, Jane	Cheetah Conservation Botswana	NGO	Employee
2016/01/25	Water flow dynamics in the Okavango Delta system	Mosimanyana, Edwin	Okavango Research Institute	Academic	Employee
2016/01/25	Conserving Brown Hyaenas across landscapes in Botswana	Winterbach, Christiaan and Maude, Glyn	Tau Consultants, Kalahari Research and Conservation	NGO-Consultant	Employee

Date	Title	Presenter	Organisation	Speaker Affiliation	Status
2016/01/25	The kid in the candy store or underfed: what drives elephant (Loxodonta africana) crop raiding?	Vogel, Susanne	EcoExist	NGO	Grad Student
2016/02/22	Status, abundance and distribution of birds in Botswana	Hancock, Pete	Raptors Botswana	NGO	Consultant
2016/02/22	Effects of a massive African elephant *Loxodonta Africana* population on plant diversity, composition and structure in northern Botswana	Fynn, Richard	Okavango Research Institute	Academic	Employee
2016/02/22	Country-wide landscape suitability for cheetah *Acinonyx jubatus* and African wild dog *Lycaon pictus*	Winterbach, Hanlie	Tau Consultants	NGO-Consultant	Grad Student
2016/03/21	Ex Africa semper aliquid novi: is pee mail private?	Apps, Peter	Botswana Predator Conservation Trust	NGO	Employee
2016/03/21	Using translocations as a tool to mitigate human-carnivore conflict	Horgan, Jane	Cheetah Conservation Botswana	NGO	Employee
2016/03/21	Baobabs, camel thorns and climate change: reconstructing a 1000 year rainfall record	Winterbach, Christiaan	Tau Consultants	NGO-Consultant	Grad Student
2016/04/18	Social networks, livelihood diversity, and adaptive capacity: measuring household resilience ad vulnerability in Habu Village, Botswana	Cassidy, Lin	EcoSurv	Consultant	Consultant
2016/04/18	When fish change sex	Edwards, Thea	University of the South	Academic	Grad Student
2016/04/18	Looking at human-wildlife conflict integrally: a conflict management and whole systems approach to addressing HWC in Botswana	Bourquin, Sara	University of Victoria	Academic	Grad Student
2016/05/23	Kalahari Connections : community outreach and conservation education	Mothibi, Kgmotso	Kalahari Research and Conservation	NGO	Employee
2016/05/23	Vegetation and wildlife habitats of the Savute-Mababe-Linyanti ecosystem, northern Botswana	Sianga, Keoikantse	Okavango Research Institute	Academic	Grad Student

Date	Title	Presenter	Organisation	Speaker Affiliation	Status
2016/05/23	Local farmers' attitudes towards African elephants in the Makgadikgadi region, Botswana	Stevens, James	Elephants for Africa (University of Bristol)	NGO	Grad Student
2016/06/27	Successes and challenges of CBNRM in Botswana	Kolawole, Toyin	Okavango Research Institute	Academic	Employee
2016/06/27	Herbivore size interacts with habitat productivity to determine plant diversity and community structure in an African savanna	Fynn, Richard	Okavango Research Institute	Academic	Employee
2016/06/27	The key principles of large carnivore conservation	Winterbach, Hanlie	Tau Consultants	NGO-Consultant	Employee
2016/07/25	Who is who: fingerprinting environmental conditions from space	Meyer, Thoralf	University of Texas	Academic	Employee
2016/07/25	Geeks in the bush: how high tech contributes to wildlife research	Apps, Peter	Botswana Predator Conservation Trust	NGO	Employee
2016/07/25	Incorporating three-dimensional vegetation structure in environmental studies	Brandt, Thomas	University of Texas	Academic	Grad Student
2016/08/29	Use of medicinal plants in Botswana	Mokobela, Masego "Jay"	Elephants for Africa (University of Botswana)	NGO	Employee
2016/08/29	Getting conservation science into use: what do the experts say?	Morrison, Monica	Stellenbosch Unijversity	Academic	Grad Student
2016/08/29	Key factors and related principles in the conservation of large African carnivores: competition, range use, and resilience	Winterbach, Christiaan	Tau Consultants	NGO-Consultant	Grad Student
2016/09/26	Effects of divergent migratory strategies on access to resources for Cape Buffalo (Syncerus caffer caffer)	Bennitt, Emily	Okavango Research Institute	Academic	Employee
2016/09/26	Painting eye patterns on livestock to reduce predator attacks: fairy tale or future tool?	Jordan, Neil	Botswana Predator Conservation Trust (University of New South Wales), Taronga Conservation Society	NGO-Grad Student	Grad Student
2016/10/24	Fish and fire – perspectives on the dynamics of fish populations in the Delta	Murray Hudson, Mike	Okavango Research Institute	Academic	Employee

Date	Title	Presenter	Organisation	Speaker Affiliation	Status
2016/10/24	Dispersal and demographic consequences in the endangered African wild dog: an overview	Gabrielle Cozzi	Botswana Predator Conservation Trust (University of Zurich)	NGO	Grad Student
2016/10/24	A pro-active GIS-based approach to prevent poaching in Botswana	Gielen, Marie-Charlotte	Cheetah Conservation Botswana	NGO	Grad Student
2016/11/21	Bulldozers and dozing bulls: human elephant conflict in the Boteti region	Isden, Jess	Elephants for Africa	NGO	Employee
2016/11/21	Ecological factors influencing large carnivore predation on livestock around Makgadikgadi and Nxai Pans National Park, Botswana	Mogwera, Kefentse M.	Okavango Research Institute	Academic	Grad Student
2016/11/21	Tectonic deformation in the Okavango Delta	Pastier, Anne-Morwenn	University of Rennes	Academic	Grad Student
2017/02/27	Renewable energy and tourism development in the Okavango Delta	Mbaiwa, Joseph	Okavango Research Institute	Academic	Employee
2017/02/27	Dung beetles in agricultural ecosystems	Sands, Byony	University of Bristol	Academic	Grad Student
2017/02/27	Functional heterogeneity of habitats and dry season forage provision in an Okavango Delta landscape, northern Botswana	Sianga, Keoikantse	Okavango Research Institute	Academic	Grad Student
2017/03/27	Tropical cyclones in the south-west Indian Ocean and their influence on Botswana weather	Moses, Oliver	Okavango Research Institute	Academic	Employee
2017/03/27	Human-wildlife conflict mitigation: the Lion Guardian concept	Bauer, Dominik	WildCru	NGO	Employee
2017/03/27	Digging up megafloods and megalakes in the Makgadikgadi –Okavango-Zambez	Bean, Robert	University of Texas – Austin	Academic	Grad Student
2017/04/24	Cape buffalo social dynamics in a flood-pulsed environment	Bennitt, Emily	Okavango Research Institute	Academic	Employee
2017/04/24	The potential value of collars for human-wildlife conflict: an example from cheetah	van der Weyde, Leeanne	Cheetah Conservation Botswana	NGO	Employee
2017/04/24	Preventing and responding to violence against women and girls in Maun	Ramaphane, Peggie and Apps, Helen	Women Against Rape	NGO	Employee

Date	Title	Presenter	Organisation	Speaker Affiliation	Status
2017/05/29	The Okavango Delta: biogeochemistry, water issues and future challenges	Conley, Daniel	Lund University	Academic	Employee
2017/05/29	Up close and personal - camera trap captures of animal behaviou	Apps, Peter	Botswana Predator Conservation Trust	NGO	Employee
2017/05/29	Migrations in the Makgadikgadi: what drives zebra and wildebeest movement in the the Makgadikgadi Pans National Park	Bartlam-Brooks, Hattie	Royal Veterinary College, Botswana Herbivore Research	NGO-Consultant	Employee
2017/06/26	Simulating the effects of different timing of upstream water uptake on Delta ecoregions	Murray Hudson, Mike	Okavango Research Institute	Academic	Employee
2017/06/26	Why do wild dogs reproduce seasonally? And will climate change impact their future? Interesting facts you thought you knew about African wild dogs	McNutt, Tico	Botswana Predator Conservation Trust	NGO	Employee
2017/06/26	**H**uman-elephant conflict in the western Okavango Panhandle	Erin Buchholtz	EcoExist (Texas A&M University)	NGO	Grad Student
2017/07/24	FIV in African lions: is it host density dependent?	Winterbach, Christiaan	Tau Consultants	NGO	Consultant
2017/07/24	Standardised wildlife monitoring protocols: a summary in film	Brooks, Chris	Botswana Herbivore Research	NGO	Consultant
2017/07/24	Vulture crisis	Reading, Rich	Okavango Research Institute (Fulbright Fellow)	Academic	Employee
2017/08/28	Cultural heritage resources conservation as sustainability enablers in African environments: Botswana case studies	Keitumetse, Susan	Okavango Research Institute	Academic	Employee
2017/08/28	The Savuti-Mababe-Linyanti ecosystem: a critical region for biodiversity conservation and long-term ecological research	Fynn, Richard	Okavango Research Institute	Academic	Employee
2017/08/28	Lisima Iwa Mwono: working to protect the Okavango's water tower	Boyes, Chris and Neef, Goetz	National Geographic Okavango Wilderness Project	NGO	Employee
2017/09/25	Access to grid electricity in Botswana: implications for	Motsholapheko, Moseki	Okavango Research Institute	Academic	Employee

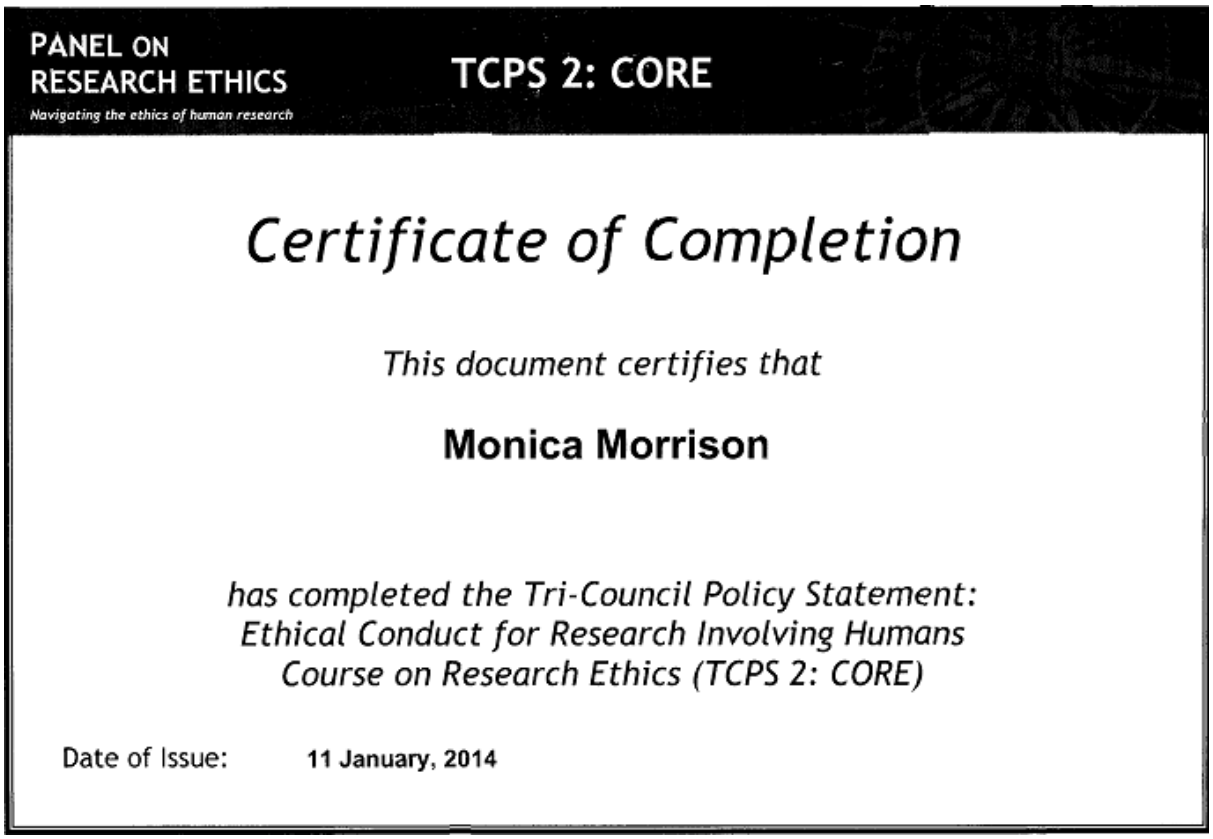
Date	Title	Presenter	Organisation	Speaker Affiliation	Status
	energy transition in the Okavango Delta				
2017/09/25	Everything you ever wanted to know about cheetah scat: how to find it and why on earth you would want to	Horgan, Jane	Cheetah Conservation Botswana	NGO	Employee
2017/09/25	Natural indicators comprising traditional checklist for subsistence communities	Botumile, Bontekanye	Okavango Research Institute	Academic	Grad Student
2017/10/30	Productive interactions? Public and research stakeholder participation in two years of Research Talks for Everyone	Morrison, Monica	Stellenbosch University	Academic	Grad Student
2017/10/30	National Geographic Okavango Wilderness Project data collection, storage and sharing	Neef, Goetz	National Geographic Okavango Wilderness Project	NGO	Employee
2017/10/30	The 'barchans' of Ntetwe Pan: implications for the Makgadikgadi Management Plan	McFarlane, Marty	Bosele Investments	Consultant	Employee

Appendix 4 List of events attended related to the thesis work

Event	Author's Role
Great Elephant Census planning meeting, Kasane, 27-28 January 2014	Invited notetaker
DWNP Wildlife Seminar, BWTI, Maun, Botswana, February 2014	Attendee
DWNP Wildlife Seminar, Maun, September 11, 2014	Attendee
Two Communities, or Community of Practice: Communicating Wildlife Research in Northern Botswana, DWNP Wildlife Seminar, Maun, March 2015	Poster presenter
Reflecting Management Priorities in Research Data, Africa Rising Biodiversity Workshop, Cape Town, Africa Rising 19 to 21 May 2015	Poster presenter
Okavango World Heritage Site Discussion Panel, Maun Lodge, 20 August 2015	Vote of Thanks
Stuart Marks seminar, Botswana Wildlife Training Institute, Maun, August 31, 2015	Attendee
Environmental Research and Filming Guidelines review Stakeholder Consultation, Maun, 9 September 2015	Invited Notetaker
Global March for Elephants and Rhinos, Maun, October 10, 2015	Observer
Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) National Workshop, Maun Lodge, 14th- 15th October 2015	Attendee
Round River wildlife monitoring annual students' presentations, ORI, 2016-2018	Attendee
ORI-Kwando Research Talks for Everyone Attendees July 2015 to March 2016, 25 April 2016	Presenter
Official ceremony to launch and unveil the Standardised Wildlife Monitoring Protocols and website, 14 July 2016	Attendee
Getting Conservation Science into Use: Insights from the Scholarly Literature, Research Talks for Everyone, 29 August 2016	Presenter

Event	Author's Role
Communicating Biodiversity : Action Research in Studying Northern Botswana's Conservation Community of Practice, SCISTIP 31 October 2016, Stellenbosch	Invited graduate student presenter
Environmental Filming and Research permits Pitso, Gaborone, 15 August 2017	Observer
Uptake of Biodiversity Research: Exploring Productive Interactions, 2nd Botswana Biodiversity Symposium Maun Lodge, Maun Botswana February 13-15, 2018	Presenter
SASSCAL Mini Science Symposium in Botswana, From Science to Policy, 21-22 March 2018	Panel Participant
The Role of Regulatory Processes in Facilitating Useable Wildlife Conservation Research in Botswana, SciDataCon 2018 conference, 7-8 November 2018, Gaborone	Presenter
Botswana's Wildlife Research Permit Process: Contributing to Better Uptake? Research Talks for Everyone, 29 April 2019	Presenter
Botswana's Wildlife Research Permit Process: Contributing to Better Uptake?, presentation to DWNP Research Unit, Maun, 27 May 2019	Presenter
The Potential of Collaborative Wildlife Monitoring in Northern Botswana Tourism Concessions to Support Management, Workshop, Review and Update of the Standardised Wildlife Monitoring System, September 27, 2019	Presenter

Appendix 5 Ethics clearance certificates



PANEL ON RESEARCH ETHICS
Navigating the ethics of human research

TCPS 2: CORE

Certificate of Completion

This document certifies that

Monica Morrison

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **11 January, 2014**

UNIVERSITEIT STELLENBOSCH UNIVERSITY

NOTICE OF APPROVAL

REC Humanities New Application Form

1 February 2018

Project number: 1707

Project Title: Surveys of wildlife research stakeholders in northern Botswana

Dear Miss Monica Morrison

Your REC Humanities New Application Form submitted on **19 December 2017** was reviewed and approved by the REC: Humanities.

Please note the following for your approved submission:

Ethics approval period:

Protocol approval date (Humanities)	Protocol expiration date (Humanities)
01 February 2018	31 January 2021

Please take note of the General Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

If the researcher deviates in any way from the proposal approved by the REC: Humanities, the researcher must notify the REC of these changes.

Please use your SU project number (1707) on any documents or correspondence with the REC concerning your project.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

FOR CONTINUATION OF PROJECTS AFTER REC APPROVAL PERIOD

Please note that a progress report should be submitted to the Research Ethics Committee: Humanities before the approval period has expired if a continuation of ethics approval is required. The Committee will then consider the continuation of the project for a further year (if necessary)

Included Documents:

Document Type	File Name	Date	Version
Proof of permission	DWNPresearchpermitaccess	10/10/2013	
Informed Consent Form	SU HUMANITIES Consent_electronic survey_Morrison	15/10/2017	1
Research Protocol/Proposal	Morrison_proposal_final	08/12/2017	final
Data collection tool	Followup in-depth interviewframeworks_university_staff.doc	08/12/2017	
Data collection tool	Followup in-depth interviewframeworks_private_sector.doc	08/12/2017	
Data collection tool	Followup in-depth interviewframeworks_government_officials.doc	08/12/2017	
Data collection tool	Followup in-depth interviewframeworks_consultants.doc	08/12/2017	
Data collection tool	Followup in-depth interviewframeworks_NGOs.doc	08/12/2017	
Data collection tool	Followup in-depth interviewframeworks_research_permit holders.doc	08/12/2017	
Data collection tool	Research_Tables_online_survey	08/12/2017	
Data collection tool	Research_Permits_online_survey	08/12/2017	
Informed Consent Form	SU HUMANITIES Consent_form-interview_Morrison	08/12/2017	
Default	SU HUMANITIES Consent_form_institutional_researchers	19/12/2017	

Default	SU HUMANITIES Consent_form_government	19/12/2017
Default	SU HUMANITIES Consent_form_independent_researchers	19/12/2017
Default	SU HUMANITIES Consent_form_private_sector	19/12/2017
Default	SU HUMANITIES Consent_form_NGO	19/12/2017
Default	SU HUMANITIES Consent_form_Consultants	19/12/2017

If you have any questions or need further help, please contact the REC office at cgraham@sun.ac.za.

Sincerely,

Clarissa Graham

REC Coordinator: Research Ethics Committee: Human Research (Humanities)

National Health Research Ethics Committee (NHREC) registration number: REC-050411-032.
The Research Ethics Committee: Humanities complies with the SA National Health Act No.61 2003 as it pertains to health research. In addition, this committee abides by the ethical norms and principles for research established by the Declaration of Helsinki (2013) and the Department of Health Guidelines for Ethical Research: Principles Structures and Processes (2nd Ed.) 2015. Annually a number of projects may be selected randomly for an external audit.

Investigator Responsibilities

Protection of Human Research Participants

Some of the general responsibilities investigators have when conducting research involving human participants are listed below:

1.Conducting the Research. You are responsible for making sure that the research is conducted according to the REC approved research protocol. You are also responsible for the actions of all your co-investigators and research staff involved with this research. You must also ensure that the research is conducted within the standards of your field of research.

2.Participant Enrollment. You may not recruit or enroll participants prior to the REC approval date or after the expiration date of REC approval. All recruitment materials for any form of media must be approved by the REC prior to their use.

3.Informed Consent. You are responsible for obtaining and documenting effective informed consent using **only** the REC-approved consent documents/process, and for ensuring that no human participants are involved in research prior to obtaining their informed consent. Please give all participants copies of the signed informed consent documents. Keep the originals in your secured research files for at least five (5) years.

4.Continuing Review. The REC must review and approve all REC-approved research proposals at intervals appropriate to the degree of risk but not less than once per year. There is **no grace period.** Prior to the date on which the REC approval of the research expires, **it is your responsibility to submit the progress report in a timely fashion to ensure a lapse in REC approval does not occur.** If REC approval of your research lapses, you must stop new participant enrollment, and contact the REC office immediately.

5.Amendments and Changes. If you wish to amend or change any aspect of your research (such as research design, interventions or procedures, participant population, informed consent document, instruments, surveys or recruiting material), you must submit the amendment to the REC for review using the current Amendment Form. You **may not initiate** any amendments or changes to your research without first obtaining written REC review and approval. The **only exception** is when it is necessary to eliminate apparent immediate hazards to participants and the REC should be immediately informed of this necessity.

6.Adverse or Unanticipated Events. Any serious adverse events, participant complaints, and all unanticipated problems that involve risks to participants or others, as well as any research related injuries, occurring at this institution or at other performance sites must be reported to Malene Fouche within **five (5) days** of discovery of the incident. You must also report any instances of serious or continuing problems, or non-compliance with the RECs requirements for protecting human research participants. The only exception to this policy is that the death of a research participant must be reported in accordance with the Stellenbosch University Research Ethics Committee Standard Operating Procedures. All reportable events should be submitted to the REC using the Serious Adverse Event Report Form.

7.Research Record Keeping. You must keep the following research related records, at a minimum, in a secure location for a minimum of five years: the REC approved research proposal and all amendments; all informed consent documents; recruiting materials; continuing review reports; adverse or unanticipated events; and all correspondence from the REC

8.Provision of Counselling or emergency support. When a dedicated counsellor or psychologist provides support to a participant without prior REC review and approval, to the extent permitted by law, such activities will not be recognised as research nor the data used in support of research. Such cases should be indicated in the progress report or final report.

9.Final reports. When you have completed (no further participant enrollment, interactions or interventions) or stopped work on your research, you must submit a Final Report to the REC.

10.On-Site Evaluations, Inspections, or Audits. If you are notified that your research will be reviewed or audited by the sponsor or any other external agency or any internal group, you must inform the REC immediately of the impending audit/evaluation.

Appendix 6 Sample semi-structured interview guide

In-depth Interview Guides for Selected Stakeholders: Government

Researchers Interview :government officials **Respondents must choose from specific projects or piece of research: as researcher, as beneficiary, as contractor (perhaps one example per government interviewee, depending on the role).**	
Questions to guide probing about productive interactions	
1. Background/context questions	1.1 Information about the interview 1.2 Interviewee profile including involvement in research, main area of work, activities carried out since research identified
2. Context	2.1 *If respondent is referring to research that the organisation contracted (financial role):* 2.1.1 What other actors/stakeholders have been the most important in determining the uptake/impact of research that your organization has sponsored or facilitated? 2.1.2 What kind of contacts do you have with these other stakeholders and what type of influence do they have? 2.1.3 Are there differences in the ways in which the different stakeholders we have discussed may influence the uptake and impact of the outcomes of the research? 2.2 *If respondent is referring to external research about which the organisation was made aware (beneficiary role):* 2.2.1 What other actors/stakeholders have been the most important in determining the uptake/impact of research carried out by external researchers? 2.2.2 What kind of contacts do you have with these other stakeholders and what type of influence do they have? 2.2.3 Are there differences in the ways in which the different stakeholders we have discussed may influence the uptake and impact of the outcomes of that research? 2.3 *If respondent is referring to research carried out by the organization (researcher role):* 2.3.1 What actors have been the most important in determining the uptake/impact of your research? Could you mention some concrete examples? 2.3.2 What type of influence do they have? Is there a recognizable influence on the research agenda? Do they offer expertise useful for you? In what way? 2.3.3 Are there differences in the ways in which these actors may influence the uptake and impact of the results (including knowledge and skills) of your research?
3. Mechanisms of interaction	3.1 Direct interactions (personal) - regular contacts with practitioners in advance of the research, e.g. research permit process - participation of stakeholders in design of research - direct contacts with stakeholders within research period - influence of these contacts on research work

In-depth Interview Guides for Selected Stakeholders: Government

	- development of these contacts within and after completion of research 3.2 Indirect interactions (text and artefacts) production of specified outputs: academic papers and articles; popular texts; grey literature and reports, web contexts, exhibitions, guidelines, standards, models role of stakeholders in creating these outputs 3.3 Financial interactions Involvement of stakeholders in the research, e.g. through contract funding or joined projects - Kind of work being conducted under formal agreement
4. Outcome/Impacts	4.1 What was in your opinion the most significant change that took place during the research process? - capacity building - conceptual use (changed ways of thinking) - instrumental use (direct impact on policy or practice) - attitudinal change (positive changes in institutional cultures and individual attitudes towards knowledge exchange - enduring connections 4.2 Do you, in any systematic or non-systematic way, follow the results of your research in society? 4.3 Have you applied in a non-academic context the knowledge or skills that you gained thanks to your involvement in this research? 4.4 Which stakeholders benefited and in what ways? - as a tool to solve stakeholder problems? - as the basis for ideas or arguments to justify, confirm or develop actions? - have they been used to design/develop services or articles for popular consumption? 4.5 If not, why?